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VOICE RESPONSE SYSTEM (VRS) SURVEY.(U)
JUL 79 E SHOCHET, H MILLIGAN, R J REGAN

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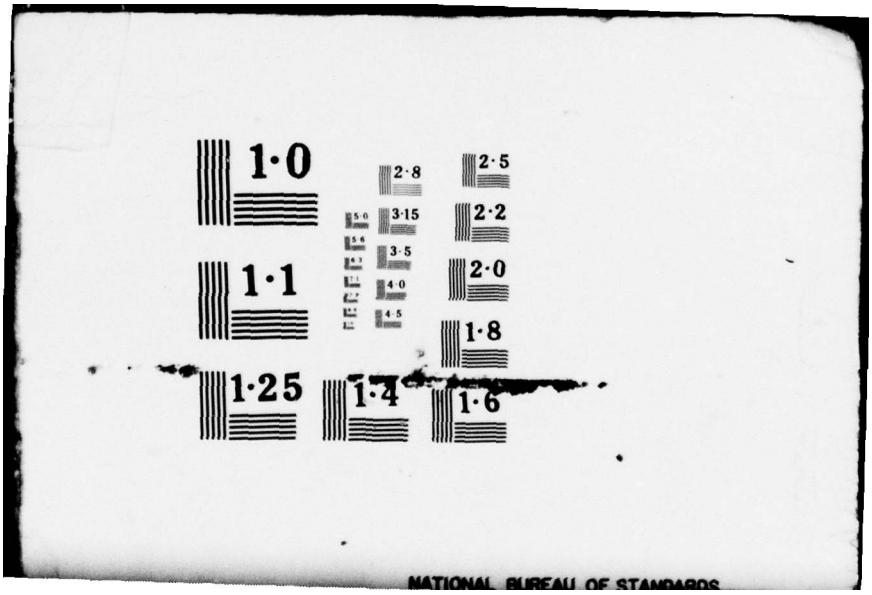
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NATIONAL BUREAU OF STANDARDS

Report No. FAA-RD-79-47

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LEVEL II

VOICE RESPONSE SYSTEM (VRS) SURVEY

Ephraim Shochet
Hugh Milligan
Richard J. Regan

JULY 1979

FINAL REPORT

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Systems Research & Development Service
Washington, D.C. 20590

NOTICE

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16. Abstract

An experiment was conducted to determine the effectiveness and acceptability of a computer-generated voice system designed to provide pilots with a limited preflight weather briefing via touchtone telephone without the intervention or assistance of a weather briefer. The test area was the District of Columbia, Fairfax County, Arlington County, Alexandria City, Prince Georges County, and Montgomery County. Questionnaires were mailed to a randomly selected group of pilots in the test area. Several followup efforts were made to obtain information from nonrespondents. Analysis of the data obtained from the questionnaires indicates (1) user pilots have a high level of acceptance of the Voice Response System; (2) the general aviation pilot can use the Voice Response System effectively; and (3) the system satisfied the preflight needs of some pilots.

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METRIC CONVERSION FACTORS

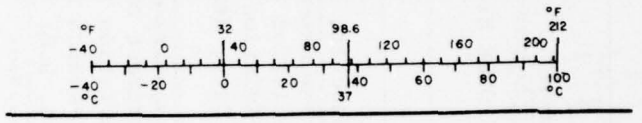
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	qwarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



PREFACE

Many people and organizations participated in the experimental live testing and pilot survey of the Voice Response System conducted in the Washington D.C. area during the summer of 1978. It would be impossible to mention them all by name; however, some deserve special mention.

Acknowledgement is given to the Aircraft Owners and Pilots Association (AOPA) and the National Pilots Association (NPA) for their efforts in encouraging pilots to participate in the evaluation of the Voice Response System (VRS).

Acknowledgement is given to Transportation Systems Center of Cambridge, Massachusetts, and Mitre Corporation of Mc Lean, Virginia, for their contributions in design and development of VRS and for the equipment description provided in this report.

Acknowledgement is given to the following FAA/NAFEC personnel and organizations;

Eugene Plofker for his assistance in writing the publicity brochure for the VRS.

Mr. Carey Weigel of ARD-441, Systems Research and Development Service, Washington D.C., Project Manager for VRS Development. Mr. Weigel helped design and supervise the live testing and pilot survey of the VRS.

Mr. Joseph Romei, former Project Manager of VRS at the National Aviation Facilities Experimental Center, for his contributions in planning and design of the live test and VRS pilot survey.

Mr. Thomas Steger and Dr. Shiu-Ming Cheung, ANA-751, for their valuable assistance in providing the required programing support for data analysis.

The Data Preparation Section, ANA-244A, for its valuable assistance in coding the VRS questionnaires.

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EXECUTIVE SUMMARY

In April 1978, the Federal Aviation Administration (FAA) conducted an experiment to determine the effectiveness and acceptability of a Voice Response System (VRS) designed to provide pilots with a limited preflight weather briefing via touch-tone telephone without the intervention or assistance of a weather briefer. The prototype model provided three weather products: hourly surface observations, terminal forecasts, and grid winds aloft. The system communicates by voice in one direction--from computer to pilot.

The VRS enables pilots to communicate with a computer to obtain weather and flight data. The pilot enters requests for specific weather reports for locations of interest by depressing the keys on a touch-tone telephone or key pad adapter on non-touch-tone telephones. The computer will "listen" to telephone signaling tones and will respond with a spoken message derived from stored human speech.

The VRS evolved into its present form after a period of controlled experimentation by FAA personnel who sought to develop suitable procedures and to acquire necessary weather products. But realistic, live experimentation was necessary to find the ways in which to maximize system usefulness and convenience of use. Thus, the VRS was publicly tested in the greater Washington D.C. area. Questionnaires were mailed to a random sample of 1,778 pilots to obtain public reaction to the VRS. Several followup efforts were made to secure information from nonrespondents.

CONCLUSIONS.

From the analysis of the questionnaire returns and telephone contacts with randomly selected nonrespondents, it is concluded that:

1. *The VRS is a practical and effective means by which pilots can, in many instances, obtain a satisfactory overview of weather conditions.* For preflight planning, 56 percent of the pilots indicated that it was unnecessary to call the Flight Service Station (FSS) for weather information after receiving the VRS briefing (figure ES-1). Of those who still found it necessary to call the FSS for weather information, 90 percent indicated that for preflight planning the VRS briefing reduced the time on line with the FSS (figure ES-2). The average estimated reduction in time on line with the FSS for preflight planning was 47 percent (figure ES-3).

2. *The VRS operating procedures are simple enough for most pilots to master with minimal practice.*

3. *The public reaction to the VRS was highly favorable. Analysis of the data obtained from the questionnaires indicates a high level of acceptance of the VRS.* As shown in (figure ES-4) 93 percent of the respondents indicated that the VRS is either "suitable with minor changes" or "suitable as is."

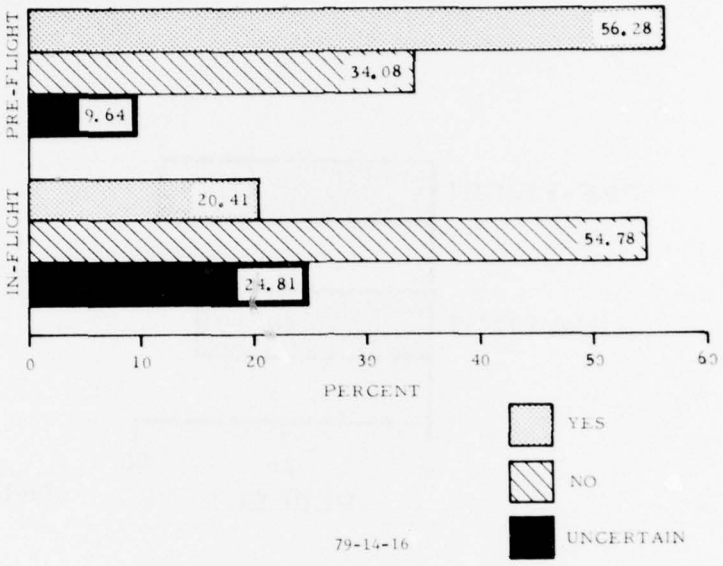


FIGURE ES-1. FSS UNNECESSARY AFTER VRS BRIEFING

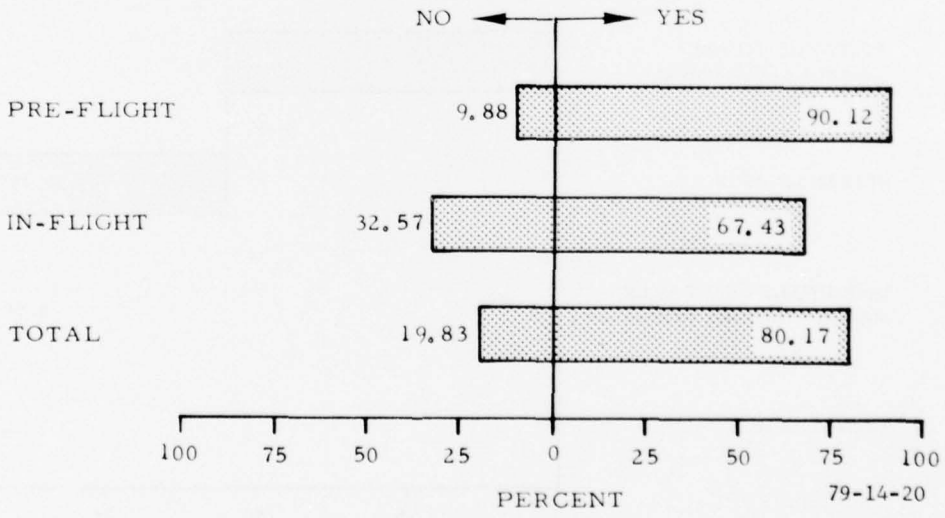


FIGURE ES-2. DID VRS BRIEFING REDUCE TIME ON LINE WITH FSS?

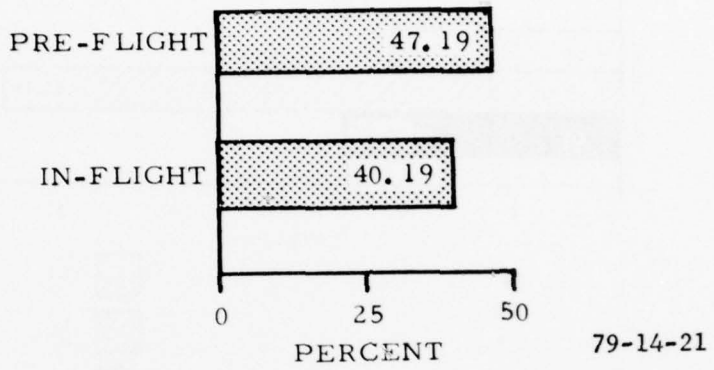


FIGURE ES-3. AVERAGE OF PERCENT TIME REDUCED

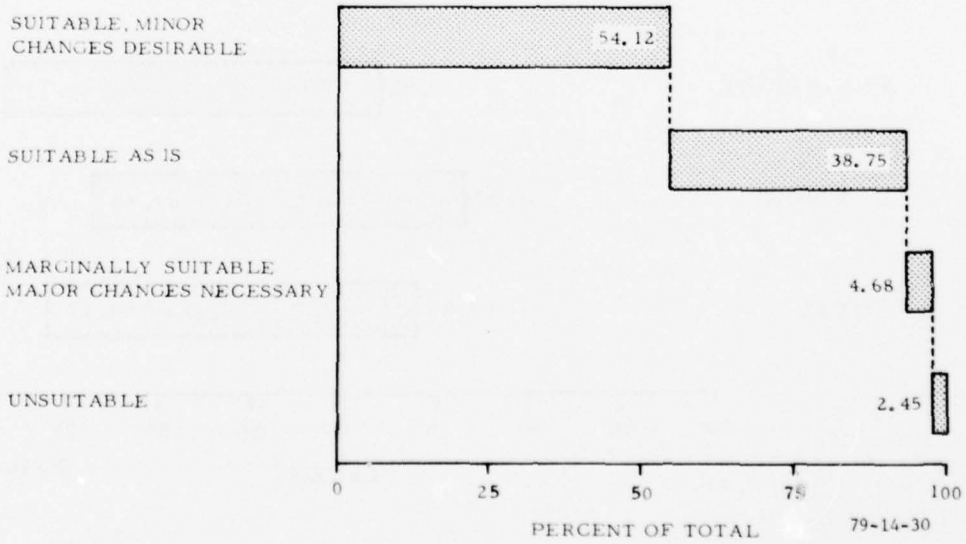


FIGURE ES-4. SUITABILITY OF THE VRS FOR WIDE-SPREAD PUBLIC USE

4. No significant difference in the results existed between license types or experience levels of general aviation pilots.

5. The quality of speech (i.e., pleasantness, rate, rhythm, intonation, and intelligibility) are acceptable for public dissemination.

6. Additional weather products and the provision of NOTAM's would provide for better overview of weather and flying conditions.

RECOMMENDATIONS.

1. The following seven additional products should be incorporated into the Voice Response System as they become available.

1. PIREP's--Pilot reports on weather
2. NOTAM's--Notices to airmen
3. SIGMET's--Significant weather information
4. AIRMET's--Airmens Meteorological Information
5. Weather Synopsis
6. Route Forecast
7. Area Forecast

2. The spoken-name readback method should be used for location indentifiers.

3. The impact of the Voice Response System on FSS specialist workload was not and connot be determined in the Washington metropolitan area due to many improvements such as MAPS, improved PATWAS, TEL-TWEB, 800 lines and consolidation. In the event a second VRS installation is implemented, it is recommended that a further study be conducted to determine the effects of the VRS on specialists' workload and that this study be performed in a controlled field environment.

INTRODUCTION

PURPOSE.

The purpose of this report is to document the results of the Voice Response System survey (VRS). The VRS survey was conducted to determine the effectiveness and acceptability of a computer-generated voice system designed to provide pilots with a limited preflight weather briefing via touchtone telephone without the intervention or assistance of a weather briefer.

BACKGROUND.

The Federal Aviation Administration (FAA) plans to implement a national Flight Service Station (FSS) automation program. This program will enable the increasing demand for services to the general aviation fleet to be met without a large increase in operating costs. Increased system capacity, easier access, and improved quality of service are important goals. The program will make extensive use of automation and will feature direct user access--direct pilot communication with the system computer to obtain a weather briefing and/or to file a flight plan.

The Voice Response System envolved into its present form after a period of controlled experimentation by FAA personnel who sought to develop suitable procedures and to acquire the necessary weather products. But realistic testing, live experimentation, was necessary to find the ways in which to maximize system usefulness and convenience of use.

TYPICAL SYSTEM TRANSACTION.

The VRS enables pilots to access a computer data base of weather and flight data. The pilot enters requests for specific weather reports for locations of interest by depressing the keys on a touchtone telephone or touchtone adapter on dial-type telephones. Almost immediately, the system responds with a spoken message derived from stored human speech. The pilot need only have a standard 12-key touch-tone telephone and a slight knowledge of the means of communicating with the Voice Response System. After connection with the system, a typical dialogue might transpire as follows:

VRS: "Hello. Greenwich time is now _____. Enter location identifier."

Pilot: The pilot depresses the touchtone keys in the manner prescribed in his brochure and enters location identifier.

VRS: The voice feature repeats the location entered either by pronouncing it phonetically or as normally spoken.

VRS: "Enter next location identifier."

Pilot: The pilot may repeat the location entry procedure until he has inserted as many as are necessary, up to a maximum of 10.

VRS: "Do you want hourly observations? Answer yes or no?"

Pilot: Enters numeric 9 (y) for yes, 6 (n) for no. (9 occurs with y and 6 occurs with n on the key pad)

VRS: If pilot responds "yes," requested hourly observations are delivered.

VRS: "Do you want terminal forecasts? Answer yes or no?"

Pilot: Enters numeric 9 for yes, 6 for no.

VRS: If pilot responds "yes," the requested information is delivered for those entered locations where terminal forecasts are made.

VRS: "Do you want forecast winds aloft? Answer yes or no?"

Pilot: Enters numeric 9 for yes, 6 for no.

VRS: "How many hours from now? The maximum is 30."

Pilot: Enters numeric.

VRS: At what altitude?

Pilot: Enters altitude.

VRS: Delivers forecast grid winds aloft for the entered altitude and for 4,000 feet above and below that altitude. (The system does not provide data for an altitude less than 2,000 feet above the terrain).

The above example is a simplified illustration of how the pilot and the VRS communicate. A more detailed account of how the system operates, its control functions, and limitations is contained in figure 1. Figure 1 is a copy of the publicity brochure that was sent to approximately 8,800 general aviation pilots in the Washington D.C. metropolitan area.

EQUIPMENT DESCRIPTION.

The VRS provides computer-generated voice output in response to inputs from a touchtone telephone. Stored within a Digital Equipment Corporation PDP 11/70 computer were the executive/operational programs required to operate the system and the raw national weather data base received from the Weather Message Switching Center (WMSC) located in Kansas City, Missouri. The data base was translated and reformated into VRS weather files. All data manipulations regarding currency and validity of the national weather data base were accomplished within this computer which was located at the MITRE Corporation facility, Mc Lean, Virginia.

The digitized voice response subsystem was located at the Transportation Systems Center (TSC), Cambridge, Massachusetts, and was connected to the MITRE-based PDP 11/70 by a 1,200-baud subchannel of a multiplexed 9,600-baud communication line. The digital subsystem is composed of four major elements; i.e., a processor, fixed-head disk, and touchtone/voice-decoding equipment.

The processor is a Digital Equipment Corporation PDP 11/34 minicomputer with 64k of core memory. It performs the functions of interpreting the touchtone inputs from the user, determining what weather information has been requested, accessing the proper weather files in the PDP 11/70, and converting the output into speech by stringing together prestored words and phrases which result in the appropriate output message.

The fixed-head disk was used to store spoken words and phrases which had previously undergone an analog-to-digital conversion. The digital output was compressed utilizing a technique known as adaptive differential pulse code modulation (ADPCM).

The process of decompressing the data stored on the disk upon retrieval was performed by the speech decoding hardware. This equipment consisted of 20 independent decoding channels which effectively reversed the process of ADPCM.

The touchtone decoding equipment consisted of 20 independent decoding channels and performed the function of decoding the touchtone inputs and routing the resultant signals to the PDP 11/34. The 20-channel system uses 10 Bell Telephone Company 407C modems and a 20-channel multiplexer to multiplex these channels into one computer input channel.

For redundancy, a second PDP 11/34 was available at TSC. In the event of a PDP 11/70 failure, the weather data base was buffered at WMSC for a limited period of time.

METHODOLOGY

SURVEY.

The VRS became operational April 15, 1978, in the test area which included the District of Columbia, Fairfax County, Arlington County, Alexandria City, Prince Georges County, and Montgomery County. In April of 1978, a brochure (figure 1) and a wallet-size card (appendix A) were mailed to approximatley 8,800 registered general aviation pilots residing in the test area. The brochure explained the reasons for the experiment, what the Voice Response System is, and how to use it. An illustrative copy of the covering letter accompanying the brochure and wallet-size card is shown in figure 2. A random sample of 1,778 names by license category was subsequently drawn from the respondent universe of approximately 8,800 general aviation pilots residing in the test area. During the week of July 21, 1978, a questionnaire (figure 3) was mailed to each potential respondent in the sample along with another copy of the brochure and wallet-size card. A copy of the covering letter to the

INTRODUCTION:

The Federal Aviation Administration is planning to implement a national Flight Service Station Automation Program. This program is designed to meet the increasing demand for services to the general aviation fleet without a large increase in operating costs. Service improvements in terms of system capacity, accessibility, and quality are high on the list of system characteristics. The program makes extensive use of automation and will introduce the concept of direct user access--the capability whereby a pilot directly accesses an FSS computer to obtain a weather briefing and/or file a flight plan. Direct pilot input and computer generated voice response are one of the primary means of providing the improved service.

BACKGROUND:

The Voice Response System (VRS) enables pilots to access a computer data base of weather and flight data. The pilot inputs requests for specific weather reports for locations of interest by utilizing the keys on a TOUCHTONE® telephone or keypad adapter on dial-type telephones. Almost immediately the system responds with a computer generated voice. To access this system, the pilot need only have a standard 12-key telephone and a slight knowledge of the manner of communicating with the voice response system. Controlled experiments were conducted by FAA personnel to develop and refine workable procedures and to establish the required weather products.

However, live experimentation is necessary to maximize system usefulness and convenience of use.

In the very near future, the FAA will conduct a live field experiment, to ascertain pilot reactions and to provide a means for pilot suggestions for improvements. Initially the weather products available will be: Surface Observations; Terminal Forecasts; and Forecast Winds Aloft. This weather information will be current. These experiments are scheduled to begin approximately April 1, 1978 and will be conducted over a period of 4 months in the Washington,D.C. area.

The three products are intended to be used for early flight planning purposes, providing the pilot with "go" or "no-go to the airport" information. The reports will be checked against predescribed criteria to assure reasonableness of data. Reports which are not received, cannot be deciphered or do not meet predetermined criteria will be voiced as "not available." Since the system does not contain all the products necessary for a complete briefing, contact your FSS for any additional information required.

OPERATING PROCEDURES:

Any public, business, or home telephone with a standard 12-key signalling system will be used to access the system. The conventional rotary dial telephone may be utilized only for dialing the access numbers, but an acoustically-coupled tone signalling device, in lieu of a TOUCHTONE® telephone, must be employed in conjunction with the rotary dial telephone to enter the information requests. Acoustically-coupled tone signalling devices (with 12- or 16-key data entry device) are generally available from electronics supply houses at low costs or can be leased from your local telephone company.

Initially, you access the Voice Response System by dialing the system access number of 347-3222. This will be a toll free call when initiated in the greater Washington metropolitan area. Otherwise, it is a standard toll call into the 347 exchange area.

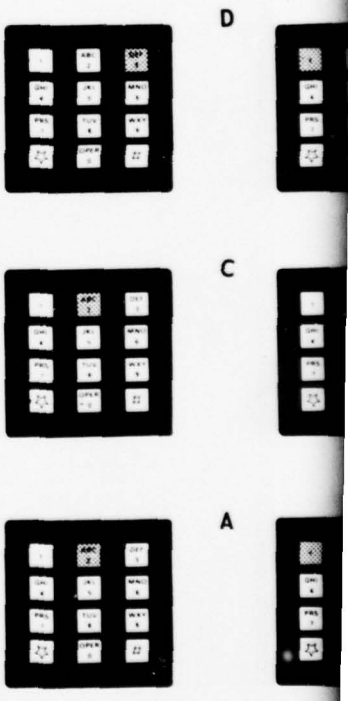
To communicate with the computer you must use the keypad in a way that the computer "understands."

KEYPAD

Locations (weather reporting stations and airports) are uniquely identified by three-letter combinations and you enter these three letter identifiers to delineate a single location or a series of locations (e.g., a proposed flightpath) for which you desire to know the weather.

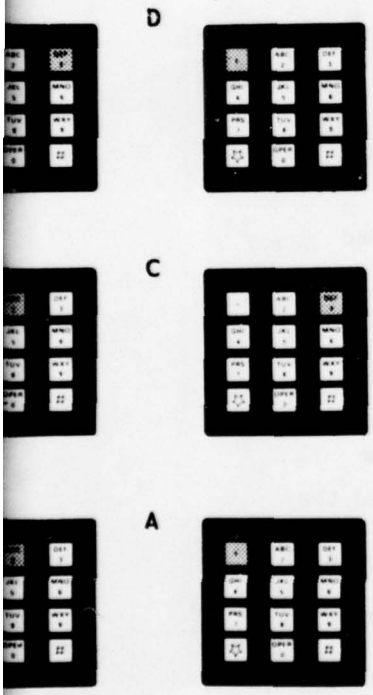
The keypad does not have enough ke
the entry of an alphabetic character (le
single keystroke. But it is possible t
unambiguous entry by depressing two
can enter a particular letter by depressi
on which that letter appears and anot
indicate which of the three letters, 1
3rd. The numeral "1" key indicates th
the numeral "2" key indicates the 2n
numeral "3" key indicates the 3rd. Thu
B is signalled by depressing the key o
appears (the number "2" key) and
numeral "2" key (2nd letter in the gr

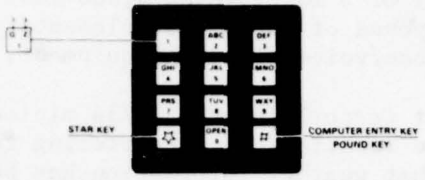
The letter C is signalled by depressing
which "C" appears and the numeral "3
letter in group ABC). For example, DCA
as D-1, C-3, A-1, as shown below.



pad does not have enough keys to allow
of an alphabetic character (letter) with a
ystroke. But it is possible to make an
ous entry by depressing two keys. You
a particular letter by depressing the key
that letter appears and another key to
which of the three letters, 1st, 2nd, or
numeral "1" key indicates the 1st letter,
eral "2" key indicates the 2nd, and the
"3" key indicates the 3rd. Thus the letter
alled by depressing the key on which B
(the number "2" key) and then the
"2" key (2nd letter in the group, ABC).

er C is signalled by depressing the key on
C" appears and the numeral "3" key (3rd
group ABC). For example, DCA is entered
C–3, A–1, as shown below.

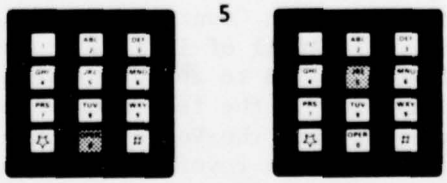




As shown above, the letters Q and Z and the blank character are assigned to the numeral "1" key. Q is 1–1, 'blank' is 1–2, and Z is 1–3. Each of the twenty–six letters of the alphabet can be entered in this fashion (two keystrokes) and no confusion will result. The 'blank' is not used.

But it does not suffice just to be able to communicate a string of letters of the alphabet to the computer. You must be able to tell the computer what you want done with the information you have provided. At the lower right–hand corner of the keypad, there is a key imprinted with a "#" symbol. We call this the 'computer entry' key or, for conciseness, the 'pound' key. Since this key is not used to transmit letters or numbers, it creates no confusion to employ it as a control key to signal an action or a request. Used in conjunction with other keys, a number of different actions can be signalled. Other control functions will be explained later.

Some location identifiers use both letter and numerals. For these entries, it is necessary to utilize two keystrokes for each letter or numeral. The context of the pilot–computer dialogue will often preclude ambiguities and permit simpler data entry. Numbers can be entered unambiguously by depressing the 'OPER' key and the appropriate numeral key. The 'OPER' key is the key representing the numeral '0' (or zero) so that entry of the numeral '0' involves two actuations of the 'OPER' key. The numeral '5' is communicated by depressing 'OPER' and '5' (as shown below) and the other numerals are similarly communicated.



The procedure described is used only for entering numbers in three–letter location identifiers with mixed letters and numbers. For all other numeric entries, single keystrokes for numbers are required. For example, if the computer 'voice' requests an altitude or a number of hours (from the present time), then the numeric entries for these fields may be made via a single keystroke for each digit of the entry.

You will seldom, if ever, be confused in practice and you will find that most of the numerical entries you need to make will require only a single key actuation per digit. In the uncommon case where you wish to enter an identifier such as 6B2 (Greenville, Maine), you will probably experience no difficulty in recognizing that the keystroke sequence should be 0–6, B–2, 0–2.

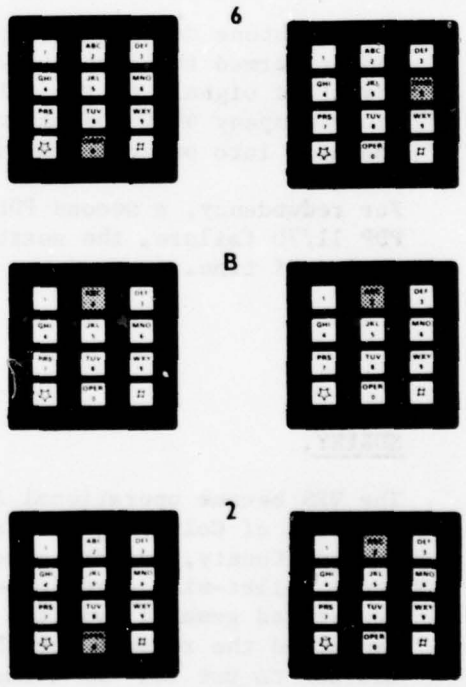


FIGURE 1. VRS BROCHURE

The computer must be able to recognize the end of an entry (i.e., a string of alphabetic, numeric or mixed characters) and the request that it respond. The computer entry key ('#'/or 'pound' key) is depressed twice to provide the end–of–entry signal immediately following each and every field. Thus, to request weather data for Martinsburg, W. Va. (and vicinity), you generate the keystroke sequence 'M–1', 'R–2','B–2', '#' '#'.

The computer will 'read back' each item entered so that you may verify the correctness of your entry. The phonetic alphabet will generally be used so that the identifier MIV will be read back as "MIKE" "INDIA" "VICTOR"; CHO will be read back as "CHARLIE" "HOTEL" "OSCAR". For some locations, the actual name of the airport will be read back to determine the mode of response preferred by pilots. For example, DCA (Washington National Airport) will be read back as "Washington National."

CONTROL FUNCTIONS:

The use of the '#' (pound) key was discussed previously. The '☆' (STAR) key is used to stop the computer response. While in the response mode, if you wish to interrupt the computer voice response, simply depress the '☆' key. You can halt the voice response until you are ready to proceed. After stopping the response, you may then order a resumption of voice response, a repeat, a jump ahead (skip), or a begin over, by selecting the appropriate keystroke sequence shown below. Notice that the enter command '#'–'#' is not required after the control functions containing the '☆' (STAR) keystroke.

ENTER	#	#		REPEAT	☆	7
YES (Y)	9	#	#	JUMP AHEAD	☆	6
NO (N)	6	#	#	DELETE	☆	3
STOP	☆			BEGIN OVER	☆	2
GO	☆	4				

Notice that "YES" or "NO" only requires three keystrokes "Y" '#' '#' or "N" '#' '#'.

AN EXAMPLE OF A TYPICAL VRS DIALOGUE:

Now that we have explained the procedures necessary to obtain access to the weather briefing, let's follow a pilot through a typical briefing.

Initially, you access the Voice Response System by dialing or keying the following telephone number––347–3222.

PILOT – pilot dials 347–3222
SYSTEM – "HELLO", "Current Greenwich Time is XXXX."
SYSTEM – "Enter Location Identifier."
PILOT – (Desired location – PIT) P–1; I–3; T–1; # #
SYSTEM – "PAPA", "INDIA", "TANGO" "ENTER NEXT LOCATION"
PILOT – (Desired location – ILG) I–3; L–3; G–1; # #
SYSTEM – "INDIA", "LIMA", "GOLF" "ENTER NEXT LOCATION"
PILOT – (If no additional entries, enter ##)
SYSTEM – "Do you want hourly surface observations? Answer yes or no."
PILOT – Y; # #
SYSTEM – reads hourlys for PIT, ILG, etc.
SYSTEM – "Do you want terminal forecasts? Answer yes or no"
PILOT – Y; # #
SYSTEM – reads forecasts for PIT and ILG
SYSTEM – "Do you want forecast winds aloft? Answer yes or no."
PILOT – Y; # #
SYSTEM – "How many hours from now? The maximum is 30."
PILOT – 6; # #
SYSTEM – "six"
SYSTEM – "At what altitude?"
PILOT – 85; (or 8500; , no matter) # #
SYSTEM – "eight five"
SYSTEM – reads winds aloft at requested altitude, +4000 feet and -4000 feet for each location.
SYSTEM – "Do you want more information? Answer yes or no."
PILOT – Y; # #
SYSTEM – "Enter location identifier, etc."

DATA NOT AVAILABLE:

When data are not available, one o
will occur:

1. Wrong Identifier: If a three–
which does not constitute a
identifier is made (e.g., ABC), the
back the characters as entered. Ho
report requested is to be read ou
say "ALPHA–BRAVO–CHARL
location identifier."

2. No Report for a Given Location
identifier is a valid one but not a r
for the type of report requested, t
"ALPHA–BRAVO–CHARLIE ... i
Observation Station" or "... is
forecast location."

3. Noncurrent Data: If the locatio
valid one but the current data ar
the VRS will say (
"SIERRA–BRAVO–YANKEE
available" for report type requeste

NOTE: 1. HOURLY OBSERV
the latest available observation
provided that the observation is n
hours old. Special observations w
to last hourly.

2. In this experime
stations for weather observatio
continental United States are cont
base.

3. Minimum altitud
winds aloft is approximately 2,
terrain level.

4. The system has
functions which limit the amo
individual can use the system.
been incorporated to preclude an
tying up the phone lines for an

DATA NOT AVAILABLE:

When data are not available, one of the following will occur:

1. Wrong Identifier: If a three–character entry which does not constitute a valid location identifier is made (e.g., ABC), the VRS will read back the characters as entered. However, when the report requested is to be read out, the VRS will say "ALPHA–BRAVO–CHARLIE...is not a location identifier."

2. No Report for a Given Location: If the location identifier is a valid one but not a reporting station for the type of report requested, the VRS will say "ALPHA–BRAVO–CHARLIE ... is not an Hourly Observation Station" or "... is not a terminal forecast location."

3. Noncurrent Data: If the location identifier is a valid one but the current data are not available, the VRS will say (e.g., SBY), "SIERRA–BRAVO–YANKEE ... report not available" for report type requested.

NOTE: 1. *HOURLY OBSERVATIONS: Only* the latest available observation will be given provided that the observation is not more than 2 hours old. Special observations will be appended to last hourly.

2. In this experiment all reporting stations for weather observations within the continental United States are contained in the data base.

3. Minimum altitude for forecasted winds aloft is approximately 2,000 feet above terrain level.

4. The system has some time–out functions which limit the amount of time an individual can use the system. This feature has been incorporated to preclude an individual from tying up the phone lines for an extended period.

HOURS OF OPERATION:

The VRS will operate from 6:00 A.M. until 8:00 P.M. daily. Pilots can access the system by calling 347–3222. This number is a local call within the Washington, D.C. exchange area. Please keep in mind that this system is experimental. There may be periods when system outages occur. During these periods, a message will be placed on the phone lines to notify pilots that the system is inoperative.

This brochure has been mailed to nearly 10,000 registered pilots in Washington, D.C. and the surrounding counties of Virginia and Maryland. This service is tailored for your needs and we request your participation in its evaluation and improvement.

If you did not receive a personal copy of this brochure or if you have any questions, please send a stamped self–addressed envelope to:

VRS
DOT/FAA/NAFEC
ANA–250
Atlantic City, N.J. 08405

We sincerely encourage your participation in this experiment. Thank you very much for your cooperation.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
National Aviation Facilities Experimental Center
Atlantic City, New Jersey

THE VOICE RESPONSE SYSTEM

Flight Service Station Automation

and

the Pilot Self Briefing

FIGURE 1. VRS BROCHURE (Continued)

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

April 1978

TO: All Computer Generated Voice Users

SUBJECT: Voice Response System (VRS) Demonstration

The Federal Aviation Administration (FAA) has developed an automated weather data dissemination system which allows a pilot to obtain a limited weather briefing without the aid of a flight service specialist. This system, which is called the "Voice Response System (VRS)," has been tested, in a controlled environment, by FAA personnel. The FAA is now ready to test the system in a "live" environment. This test is scheduled to begin on or about April 1, 1978, and will be conducted over a period of 4 months.

The purpose of VRS is to provide pertinent meteorological information to the pilot, while still at home or office, through the use of a push-button telephone. The material presented in the VRS is current weather data as reported at the time of access. The demonstration system will provide three preflight weather products: hourly surface observations, terminal forecasts, and forecast winds aloft. These products are intended to be used for early flight planning purposes. Since the system does not contain all the recommended weather and flight data products required for a complete preflight briefing, its use is not intended to completely replace a Flight Service Station specialist briefing. Further development of the VRS concept is underway to expand the capabilities of the system.

The enclosed brochure contains instructions on how to use and operate the system. Pilots can access the system by calling 347-3222. This number is a local call within the Washington, D.C., exchange area. VRS operation will be available through July 1978, from 6:00 a.m. until 8:00 p.m. daily. Since the system is experimental and not equipped for extended or redundant operation, some system outages will occur. During these periods, a message will be placed on the phone lines to notify pilots the VRS is not operating. It is important to note that use of the VRS requires a push-button telephone. Rotary dial phones can only be used in conjunction with an auxiliary push-button pad. These adaptive pads can be leased from your local telephone company or purchased from numerous telephone equipment or electronic supply outlets.

(over)

FIGURE 2. COVER LETTER TO VRS BROCHURE

Pilot participation in this demonstration is encouraged. The FAA is currently finalizing an activity to obtain pilot reaction and comments regarding operational use of the VRS during the demonstration. Further information concerning this aspect of the demonstration will be disseminated during May 1978.

Once again, we urge you to help us evaluate this new concept. Your assistance is welcomed and appreciated by FAA.

Sincerely,

DAVID J. SHEFTEL
Director, Systems Research
and Development Service

Enclosure

FIGURE 2. COVER LETTER TO VRS BROCHURE (CONTINUED)

Form Approved. OMB No. 04-S78010

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
VOICE RESPONSE SYSTEM (VRS) SURVEY

This report is authorized by the Federal Aviation Act, Section 303 and 311. While you are not required to respond, your cooperation is needed to make the results of this survey comprehensive, accurate, and timely.

1. What license/rating do you hold?

1 ☐ Student
2 ☐ Private, VFR
3 ☐ Private, IFR
4 ☐ Commercial, VFR
5 ☐ Commercial, IFR
6 ☐ Airline Transport

2. a. Total flying time _____ Hours

b. No. of hours during the past 12 months _____

3. Your city and/or county of residence. _____

4. Have you used the VRS?

(1) ☐ Yes? If yes, estimated No. of times _____
(2) ☐ No. No touchtone phone available
(3) ☐ No. Please explain in block 12 below.

If NO, please return your cooperation is appreciated.

5. Where do you normally get your weather briefing?

1 ☐ Flight Service Station
2 ☐ National Weather Service
3 ☐ Other (Specify)

6. Place a check mark in the column which best describes the extent to which you agree with each of the following statements as they apply to your general use of the VRS.

	STRONGLY DISAGREE (1)	DISAGREE (2)	UNCERTAIN (3)	AGREE (4)	STRONGLY AGREE (5)
a. The order in which the information was presented was satisfactory	☐	☐	☐	☐	☐
b. The information was sufficient to make a decision to go to the airport	☐	☐	☐	☐	☐
c. The speech rate was too fast	☐	☐	☐	☐	☐
d. The information provides a clear mental picture of the weather	☐	☐	☐	☐	☐
e. Not enough information was provided	☐	☐	☐	☐	☐
f. The VRS operating procedures were difficult	☐	☐	☐	☐	☐
g. The speech was intelligible	☐	☐	☐	☐	☐
h. The speech rhythm and intonation was unnatural	☐	☐	☐	☐	☐
i. The speech on the VRS was unpleasant	☐	☐	☐	☐	☐
j. The briefing was satisfactory	☐	☐	☐	☐	☐

7. Did the briefing received from the VRS make it unnecessary for you to call the Flight Service Station (FSS) for weather information?

a. Pre-flight
(1) ☐ Yes (2) ☐ No (3) ☐ Uncertain

b. In-flight
(1) ☐ Yes (2) ☐ No (3) ☐ Uncertain

8. If you still had to call the FSS for weather information, did the VRS briefing reduce the time on the line with the FSS?

a. Pre-flight
(1) ☐ Yes (2) ☐ No
% Time Reduced _____

b. In-flight
(1) ☐ Yes (2) ☐ No
% Time Reduced _____

9. Of the two readback methods for location identifiers, which do you prefer? (1) ☐ Phonetics *PIT (Papa, India, Tango)* (2) ☐ Spoken name *PIT (Pittsburgh)*

10. Based on your experience with the VRS, would you use it if implemented permanently?

1 ☐ For a complete weather briefing
2 ☐ For an overview of the weather conditions
3 ☐ For an update after a briefing from another source
4 ☐ Not at all (Why)? (Explain in block 12)

11. Suitability of the VRS for wide-spread public use.

1 ☐ Suitable, as is
2 ☐ Suitable, minor changes desirable
3 ☐ Marginally suitable, major changes necessary
4 ☐ Unsuitable

12. If there are any comments or suggestions you would like to make regarding the VRS, please record them here.

_____

_____

_____

_____

_____

_____

Thank You

FAA FORM NA 6490-1 (Use expires Sept. 1978)

FIGURE 3. VRS QUESTIONNAIRE

questionnaire is shown in figure 4. Subsequent followup letters to nonrespondents are shown in appendix A. A copy of the letter mailed to all pilots not selected for the VRS survey is shown in appendix A.

Table 1 summarizes the VRS test procedures and time periods. The summary of the questionnaire returns by individual mailing and pilot license category is shown in table 2.

VRS QUESTIONNAIRE.

The VRS questionnaire uses the Likert technique (reference 1). The Likert-type questionnaire consists of statements which are presented to the subject with instructions that he is to indicate his level of agreement or disagreement to each statement. The subject does so by marking one of five or seven places on a vertical scale ranging from "strongly or completely agree" to "strongly or completely disagree." The agree/disagree version of the Likert-type scale has undergone a number of years of research since it was first published by Rensis Likert in the early 30's. It has been used extensively in attitude research. The Likert-type scale was used in the New York City PATWAS questionnaire with good results (reference 2).

The VRS questionnaire contains some items that are stated in the positive form and others in the negative. It is in accord with the best current design practice to vary the dimensionality of the "favorable" or approve response category. As stated by experimental psychologist, Dr. Richard Sulzer of NAFEC:

"A well constructed questionnaire or self-report scale should contain safeguards against common sources of error, such as the "halo effect" (the tendency to be unduly influenced by a single or overall favorable aspect when rating separate dimensions).

"If the system being evaluated is viewed positively, and the first several items call for a "highly approve" rating, there is a tendency for later items to be rated in the same way "highly approve" or "strongly agree that it is good," despite the fact that on one or more of these later items, there might be a tendency toward less actual agreement or approval.

"In the VRS questionnaire, we are seeking independent ratings on various factors. It is quite reasonable to assume that some aspects of the system are actually better than others. Some warrant, no doubt, universal approval; others may be capable of improvement. We want the respondents to read and respond to each item independent of the previous item or of any overall (halo) attitude that applies to the VRS system."

SAMPLE SIZE.

Using computer-generated random numbers, a random sample of 1,778 names by license category was drawn from the respondent universe of approximately 8,800 pilots. A smaller permissible error of estimation was established for private and commercial pilots, since they represent the critical user group.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

Form Approved
OMB No. 04-S78010
Use Expires September 1978

July 1978

TO: All Computer Generated Voice Users

SUBJECT: Voice Response System (VRS) Survey

The Federal Aviation Administration is engaged in an operational demonstration of a Computer Generated Voice Response System. You have been selected from a random sample to participate in a pilot survey regarding the feasibility of the concept.

The VRS is one of the few projects where you may actually "see" the benefits derived from automation. Since you will access the system directly, your needs must be satisfied and the system should be configured (as much as possible) to be acceptable to you. We need the benefit of your experience through informed criticism and comments to improve the system design and performance. This system will serve a wide range of users with different experience levels, equipment, requirements, etc., so we must determine the format and information content that best serve all users in terms of safety, efficiency and economy.

As a participant in this demonstration, we are asking you to voluntarily complete the enclosed FAA Form NA-6490-1, Voice Response System Survey. This form is a postage-paid, self-addressed mailer. Please leave your address label on the survey such that we can accurately determine the sample response. After you have completed all the items, fold at the fold marks, tape it closed and drop it in any United States mailbox. Since we do have a time limit on this survey, we would appreciate its return within fourteen (14) days.

Your assistance is welcomed and appreciated by the Federal Aviation Administration.

Sincerely,

David J. Sheftel

DAVID J. SHEFTEL
Director, Systems Research
and Development Service

Enclosure

FIGURE 4. COVER LETTER TO VRS QUESTIONNAIRE

TABLE 1. VRS TEST PROCEDURES AND TIME PERIOD

Time Period		Test Procedure
Starting	Ending	
Prior to	April 1978	Planning and Design
March 15, 1978	-	Distribution of Announcements of Test and Descriptive Material
April 1, 1978	-	Equipment Operational
July 21, 1978	July 23, 1978	Initial Distribution of Questionnaire
August 11, 1978	August 12, 1978	First Followup Mailing of Questionnaire
August 31, 1978	September 1, 1978	Second Followup Mailing of Questionnaire
September 18, 1978	September 29, 1978	Telephone Contacts with Random Sample of Nonrespondents

TABLE 2. SUMMARY OF QUESTIONNAIRE RETURNS

INITIAL MAILING (7/21/78)

Pilot Rating	Questionnaires Mailed	Questionnaires Not Delivered	Questionnaires Returned	Percentage Of Returns (based on questionnaires mailed)	Percentage Of Returns (based on questionnaires delivered)
Student	190	10	22	11.58	12.22
Private	710	25	136	19.15	19.85
Commercial	704	34	112	15.91	16.72
ATR	174	4	30	17.24	17.65
Totals	1,778	73	300	16.87	17.60

FIRST FOLLOWUP (8/11/78)

Pilot Rating	Questionnaires Mailed	Questionnaires Not Delivered	Questionnaires Returned	Percentage Of Returns (based on questionnaires mailed)	Percentage Of Returns (based on questionnaires delivered)
Student	158	3	23	14.56	14.84
Private	549	8	110	20.04	20.33
Commercial	558	16	107	19.18	19.74
ATR	140	0	23	16.43	16.43
Total	1,405	27	263	18.72	19.09

TABLE 2. SUMMARY OF QUESTIONNAIRE RETURNS (Continued)

SECOND FOLLOWUP (8/31/78)

Pilot Rating	Questionnaires Mailed	Questionnaires Not Delivered	Questionnaires Returned	Percentage Returns (based on questionnaires mailed)	Percentage Returns (based on questionnaires delivered)
Student	132	1	11	8.33	8.40
Private	431	6	53	12.30	12.47
Commercial	435	15	59	13.56	14.05
ATR	117	1	15	12.82	12.93
Totals	1,115	23	138	12.38	12.64

SUMMARY

Potential Respondents	Questionnaires Returned	Percentage of Returns
1,778	701	39.43

THIRD FOLLOWUP

(Telephone Contact With Random Sample of Nonrespondents)

The third followup consisted of telephone calls to 600 nonrespondents who were randomly selected. Of those called, 212 were contacted. The majority of those reached had not responded because they had either stoped flying, had not flown recently, or did not have access to a touch-tone telephone.

For airline transport rating (ATR) pilots, a less stringent permissible error was justified on the basis that these pilots, for the most part, use other sources to obtain weather information and thus do not represent a critical user group. Similarly, a 10-percent permissible error was allowed for student pilots on the basis that the student pilot is not yet fully capable of making autonomous decisions regarding the weather. The sample size was determined by the formula

$$n = \frac{N}{1 + Ne^2}$$ as follows:

License	Permissible Error (%)	Sample
Student	10	95
Private	5	355
Commercial	5	352
ATR	10	87
Total		889

Since it was estimated that more than 50 percent of the potential respondents did not have immediate access to a touchtone telephone, it was necessary to double the calculated sample size to a total of 1,778. Final sample size of license pilot categories was established as follows:

License	Sample
Student	190
Private	710
Commercial	704
ATR	174
Total	1,778

The sample was not constrained by county of residence, since the process of randomization would ensure a representative sample by county.

DERIVATION OF FORMULA FOR DETERMINING SAMPLE SIZE.

The derivation of the formula,

$$n = \frac{N}{1 + Ne^2}$$

appears in "Statistics" by Taro Yamane, 2nd edition, as follows:
For a large n where the normal approximation is applicable, the 95-percent confidence interval is

$$p - 1.96\sigma_p < \pi < p + 1.96\sigma_p \tag{1}$$

where σ_p is $\sigma_p = \sqrt{\frac{\pi(1-\pi)}{n}}$

Equation (1) may be rewritten as

$$-1.96\sigma_p < p - \pi < 1.96\sigma_p \tag{2}$$

Using the notation e = p - π, equation (2) can be rewritten as

$$-1.96\sigma_p < e < 1.96\sigma_p$$

Considering the upper tail, we can set

$$e = 1.96\sigma_p \tag{3}$$

By squaring both sides we obtain

$$e^2 = (1.96)^2 \frac{\pi(1-\pi)}{n} \tag{4}$$

If we include the finite population correction we get

$$e^2 = (1.96)^2 \frac{\pi(1-\pi)}{n} \cdot \frac{N-n}{N}$$

Solving this equation for n we obtain (5)

$$n = \frac{(1.96)^2\pi(1-\pi)N}{(1.96)^2\pi(1-\pi) + Ne^2}$$

Since π is usually unknown, formula (5) is changed as follows

$$n = \frac{(1.96)^2 N}{(1.96)^2 + \frac{Ne^2}{\pi(1-\pi)}} \tag{6}$$

If we set $\pi = 1/2$, we know that the sample size will in general be larger than necessary. Substituting $\pi = 1/2$ into (5) we get

$$n = \frac{(1.96)^2(0.5)^2N}{(1.96)^2(0.5)^2 + Ne^2} \tag{7}$$

As further simplification, Yamane uses 2 normal deviates instead of 1.96 normal deviates. Yamane points out that when 2 is used instead of 1.96, a larger sample will be obtained, and the confidence coefficient becomes larger. Then 2 normal deviates will provide a 95.44-percent confidence interval instead of a 95-percent confidence interval. It should be noted, however, that this slight difference will have no significant effect in practical applications. Thus, if we substitute 2 into equation (7) we get

$$n = \frac{(2)^2(0.5)^2N}{(2)^2(0.5)^2 + Ne^2} = \frac{N}{1 + Ne^2} \tag{8}$$

A tabulation of this formula was compiled by the Bureau of Research, New York State Division of Housing and Community Renewal, "A Method for Employing Sampling Techniques in Housing Surveys."

RESULTS AND INTERPRETATION

RESPONSES TO VRS QUESTIONNAIRE.

PERCENTAGE DISTRIBUTION OF RESPONSES TO QUESTION 6. Table 3 summarizes the percentage distribution of responses to each of the 10 items comprising question 6. The circled percentages represent the dominant responses to each of the 10 stimulus items. The number of respondents producing each of the percentages is shown in table 4. The percentage distribution of responses to question 6 are depicted graphically in figure 5.

PERCENT OF RESPONSES FAVORABLE TO VRS. As indicated in table 3, all of the dominant responses to question 6 are favorable to the VRS. As shown in figure 6, 82.72 percent of all responses to question 6 are favorable to the VRS.

This percentage is obtained by adding together the number of responses in the Agree and Strongly Agree columns for items 6a, 6b, 6d, 6g, and 6j plus the number of responses in the Disagree and Strongly Disagree columns for items 6c, 6e, 6f, 6h, and 6i and dividing the result by the total number of responses.

TABLE 3. RESPONSES TO QUESTION 6--PERCENTAGES

	Statement	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree	Total
a	The order in which the information was presented was satisfactory	0.44	1.77	2.43	(69.76)	25.61	100.00
b	The information was sufficient to make a decision to go to the airport	0.44	6.42	6.42	(59.73)	26.99	100.00
c	The speech rate was too fast	31.42	(55.53)	4.20	5.97	2.88	100.00
d	The information provides a clear mental picture of the weather	0.89	9.56	16.00	(64.44)	9.11	100.00
e	Not enough information was provided	8.20	(51.00)	19.29	18.63	2.88	100.00
f	The VRS operating procedures were difficult	28.92	(54.30)	6.40	7.06	3.31	100.00
g	The speech was intelligible	9.67	10.33	1.32	(42.42)	36.26	100.00
h	The speech rhythm and intonation was unnatural	23.52	(57.58)	9.23	9.01	0.66	100.00
i	The speech on the VRS was unpleasant	35.82	(60.44)	2.86	0.22	0.66	100.00
j	The briefing was satisfactory	1.32	5.05	7.69	(63.30)	22.64	100.00
	Total	14.08	31.21	7.57	34.03	13.11	100.00

Note: The circled percentages represent the dominant responses to each stimulus item.

TABLE 4. RESPONSES TO QUESTION 6--NUMBER OF RESPONDENTS

	Statement	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree	Total
a	The order in which the information was presented was satisfactory	2	8	11	316	116	453
b	The information was sufficient to make a decision to go to the airport	2	29	29	270	122	452
c	The speech rate was too fast	142	251	19	27	13	452
d	The information provides a clear mental picture of the weather	4	43	72	290	41	450
e	Not enough information was provided	37	230	87	84	13	451
f	The VRS operating procedures were difficult	131	246	29	32	15	453
g	The speech was intelligible	44	47	6	193	165	455
h	The speech rhythm and intonation was unnatural	107	262	42	41	3	455
i	The speech on the VRS was unpleasant	163	275	13	1	3	455
j	The briefing was satisfactory	6	23	35	288	103	455
	Total	638	1414	343	1542	594	4531

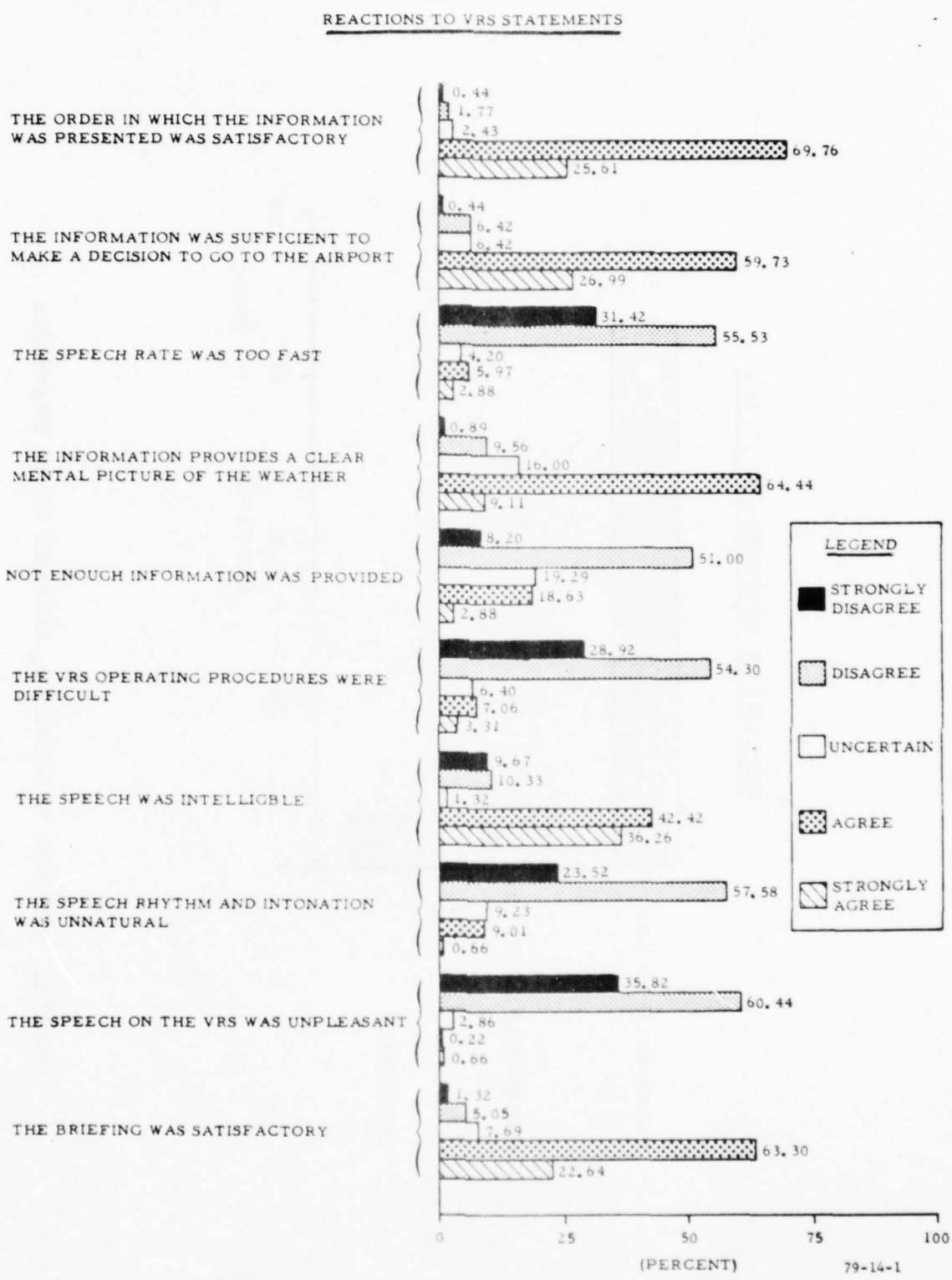


FIGURE 5. RESPONSES TO VRS STATEMENTS IN QUESTION 6

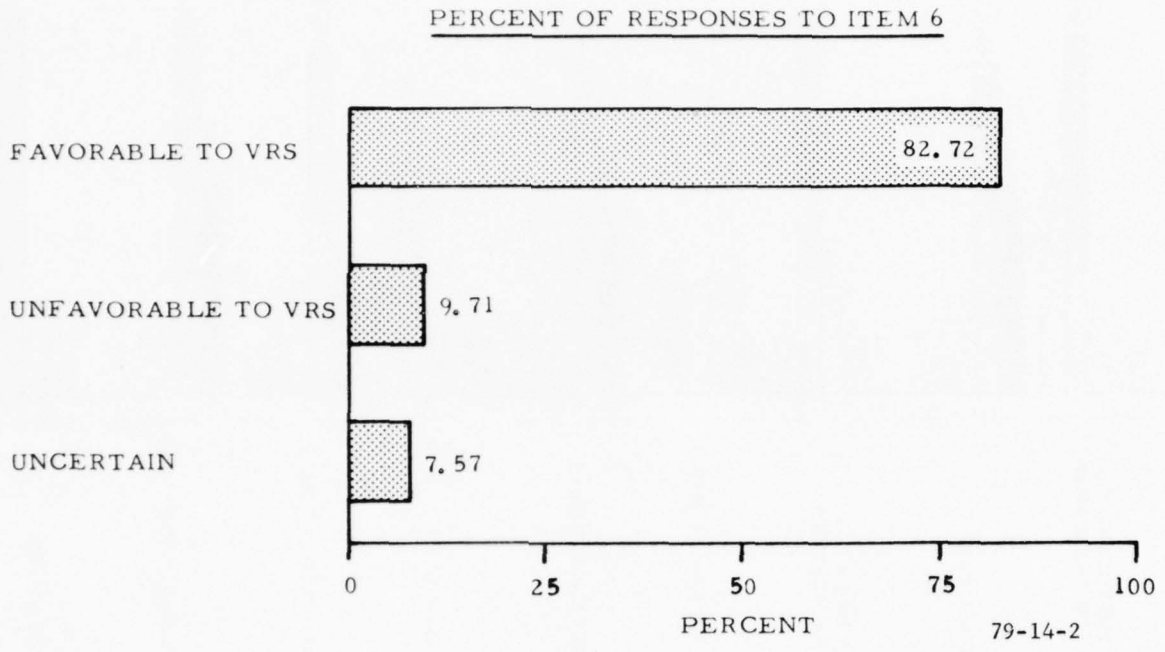


FIGURE 6. RESPONSES TO QUESTION 6, FAVORABLE VERSUS UNFAVORABLE

While all of the stimulus items in question 6 produced a favorable response to the VRS, the range of individual responses varied considerably. Item 6i, "The Speech on the VRS was unpleasant" produced the highest favorable response (Disagree 60.44% + Strongly Disagree 35.82% = 96.26%). Item 6e, "Not enough information was provided," produced the lowest favorable response (Disagree 51.00% + Strongly Disagree 8.20% = 59.20%). Figure 7 shows the percentage difference in favorability between each stimulus item in question 6. As shown in figure 6, 82.72 percent of all responses to question 6 were favorable to the VRS, 9.71 percent were unfavorable, and 7.57 percent were uncertain. It should be noted that while item 6g, "The Speech Was Intelligible," yielded a 78.68-percent favorable response, it produced the highest intense reaction--"Strongly Agree" = 36.26 percent.

POPULATION CONSISTENCY. Tables 5 through 14 and figures 8 through 17 compare the responses to question 6 from three populations, which consist of respondents to the (1) initial mailing, (2) first followup, and (3) second followup group. The three separate populations, which covered a comparable sample of individuals in three separate mailings gave approximately the same results. A chi-square analysis showed that there is no statistically significant difference between the distribution of responses to question 6 from the three populations. All chi-square tests were conducted at the .05 level of significance. In all cases in which the three populations were compared, the null hypothesis (i.e., no significant difference) was accepted. A Kolmogorov-Smirnov test, using the formula

$$D = 1.36 \sqrt{\frac{n_1 + n_2}{n_1 n_2}}$$

confirmed this result. It should be noted that the greater the correspondence between the results from the different samples, the more confidence that can be placed in the findings. In addition, the finding that no statistically significant difference exists between the three mailings not only increases the reliability of the data but also shows that the data obtained from the three mailings can be combined.

SMALL EXPECTED VALUES.

The chi-square (χ^2) distribution is made under the assumption that the expected values are not too small. What constitutes an expected value that is too small is somewhat controversial and imprecise. It has been commonly stated in the literature that expected values should be greater than 5 for the chi-square test to be valid. Some writers, however, have expressed the opinion that this criterion is too stringent, and have suggested less conservative criteria.

A common procedure for overcoming this problem has been to combine categories with small expected values. However, as Everitt (reference 3) has pointed out, "Such a procedure may be criticized for several reasons. Firstly, a considerable amount of information may be lost by the combination of categories, and

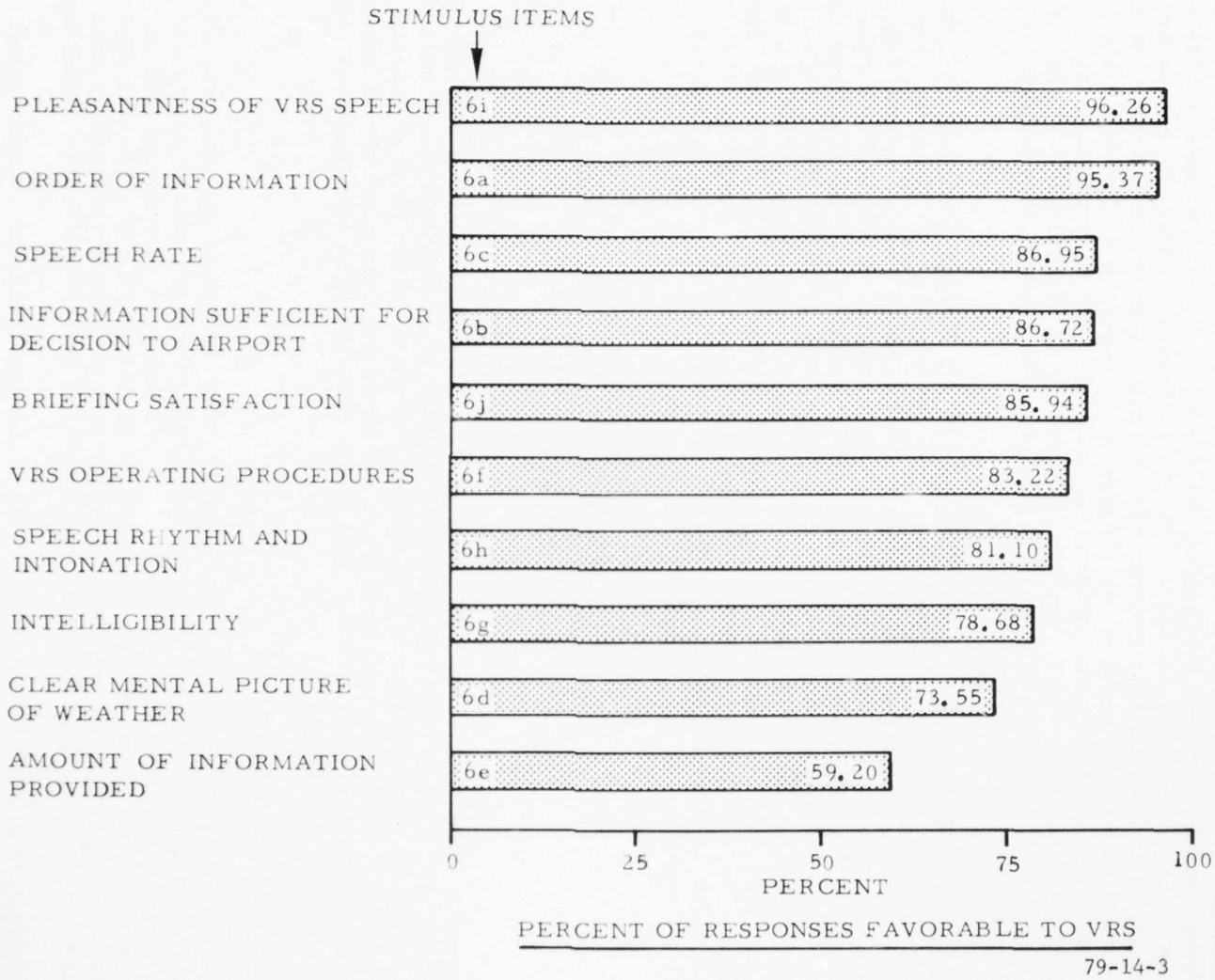


FIGURE 7. RANK ORDER OF FAVORABLE RESPONSES TO QUESTION 6

TABLE 5. RESPONSES TO QUESTION 6a

THE ORDER IN WHICH THE INFORMATION WAS PRESENTED WAS SATISFACTORY

Questionnaire Returns	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Initial Mailing	1	0.47	4	1.87	4	1.87	154	71.96	51	23.83	214	100.00
First Followup	1	0.60	4	2.41	4	2.41	110	66.27	47	28.31	166	100.00
Second Followup	0	0	0	0	3	4.11	52	71.23	18	24.66	73	100.00
Total	2	0.44	8	1.77	11	2.43	316	69.76	116	25.61	453	100.00

TABLE 6. RESPONSES TO QUESTION 6b

THE INFORMATION WAS SUFFICIENT TO MAKE A DECISION TO GO TO THE AIRPORT

Questionnaire Returns	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Initial Mailing	1	0.47	18	8.41	15	7.01	130	60.75	50	23.36	214	100.00
First Followup	1	0.61	10	6.06	11	6.67	94	56.97	49	29.70	165	100.00
Second Followup	0	0	1	1.37	3	4.11	46	63.01	23	31.51	73	100.00
Total	2	0.44	29	6.42	29	6.42	270	59.73	122	26.99	452	100.00

TABLE 7. RESPONSES TO QUESTION 6c

The Speech Rate Was Too Fast

Questionnaire Returns	Strongly Disagree N	%	Disagree N	%	Uncertain N	%	Agree N	%	Strongly Agree N	%	Total N	%
Initial Mailing	68	31.63	121	56.28	10	4.65	10	4.65	6	2.79	215	100.00
First Followup	49	29.52	94	56.63	6	3.61	13	7.83	4	2.41	166	100.00
Second Followup	25	35.21	36	50.70	3	4.23	4	5.63	3	4.23	71	100.00
Total	142	31.42	251	55.53	19	4.20	27	5.97	13	2.88	452	100.00

TABLE 8. RESPONSES TO QUESTION 6d

The Information Provides a Clear Mental Picture of the Weather

Questionnaire Returns	Strongly Disagree N	%	Disagree N	%	Uncertain N	%	Agree N	%	Strongly Agree N	%	Total N	%
Initial Mailing	2	0.93	23	10.75	44	20.56	129	60.28	16	7.48	214	100.00
First Followup	2	1.22	16	9.76	18	10.98	110	67.07	18	10.98	164	100.00
Second Followup	0	0	4	5.56	10	13.89	51	70.83	7	9.72	72	100.00
Total	4	0.89	43	9.56	72	16.00	290	64.44	41	9.11	450	100.00

TABLE 9. RESPONSES TO QUESTION 6e

Not Enough Information Was Provided

Questionnaire Returns	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Initial Mailing	16	7.48	98	45.79	50	23.36	42	19.63	8	3.74	214	100.00
First Followup	15	9.15	97	59.15	26	15.85	24	14.63	2	1.22	164	100.00
Second Followup	6	8.22	35	47.95	11	15.07	18	24.66	3	4.11	73	100.00
Total	37	8.20	230	51.00	87	19.29	84	18.63	13	2.88	451	100.00

TABLE 10. RESPONSES TO QUESTION 6f

The VRS Operating Procedures Were Difficult

Questionnaire Returns	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Initial Mailing	66	30.84	119	55.61	10	4.67	13	6.07	6	2.80	214	100.00
First Followup	51	30.54	83	49.70	14	8.38	13	7.78	6	3.59	167	100.00
Second Followup	14	19.44	44	61.11	5	6.94	6	8.33	3	4.17	72	100.00
Total	131	28.92	246	54.30	29	6.40	32	7.06	15	3.31	453	100.00

TABLE 11. RESPONSES TO QUESTION 6g

THE SPEECH WAS INTELLIGIBLE

Questionnaire Returns	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Initial Mailing	26	12.04	26	12.04	4	1.85	83	38.43	77	35.65	216	100.00
First Followup	13	7.83	14	8.43	2	1.20	75	45.18	62	37.35	166	100.00
Second Followup	5	6.85	7	9.59	0	0	35	47.95	26	35.62	73	100.00
Total	44	9.67	47	10.33	6	1.32	193	42.42	165	36.26	455	100.00

TABLE 12. RESPONSES TO QUESTION 6h

THE SPEECH RHYTHM AND INTONATION WAS UNNATURAL

Questionnaire Returns	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Initial Mailing	57	26.39	116	53.70	23	10.65	19	8.80	1	0.46	216	100.00
First Followup	32	19.28	105	63.25	15	9.04	13	7.83	1	0.60	166	100.00
Second Followup	18	24.66	41	56.16	4	5.48	9	12.33	1	1.37	73	100.00
Total	107	23.52	262	57.58	42	9.23	41	9.01	3	0.66	455	100.00

TABLE 13. RESPONSES TO QUESTION 6i

THE SPEECH ON THE VRS WAS UNPLEASANT

Questionnaire Returns	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Initial Mailing	84	38.89	123	56.94	9	4.17	0	0	0	0	216	100.00
First Followup	56	33.73	106	63.86	2	1.20	0	0	2	1.20	166	100.00
Second Followup	23	31.51	46	63.01	2	2.74	1	1.37	1	1.37	73	100.00
Total	163	35.82	275	60.44	13	2.86	1	0.22	3	0.66	455	100.00

TABLE 14. RESPONSES TO QUESTION 6j

THE BRIEFING WAS SATISFACTORY

Questionnaire Returns	Strongly Disagree		Disagree		Uncertain		Agree		Strongly Agree		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Initial Mailing	4	1.86	12	5.58	18	8.37	134	62.33	47	21.86	215	100.00
First Followup	2	1.20	9	5.39	9	5.39	110	65.87	37	22.16	167	100.00
Second Followup	0	0	2	2.74	8	10.96	44	60.27	19	26.03	73	100.00
Total	6	1.32	23	5.05	35	7.69	288	63.30	103	22.64	455	100.00

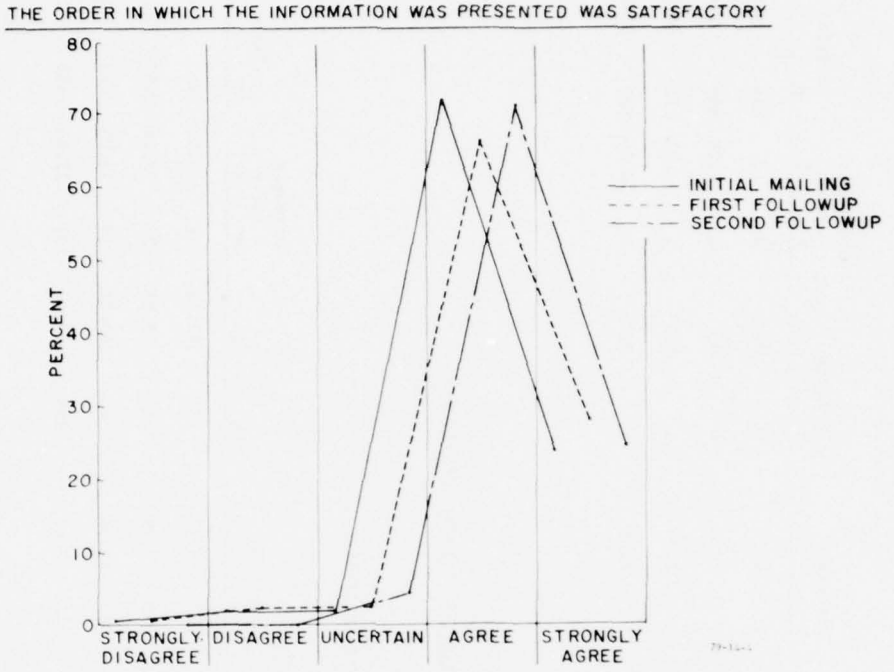


FIGURE 8. RESPONSES TO QUESTION 6a

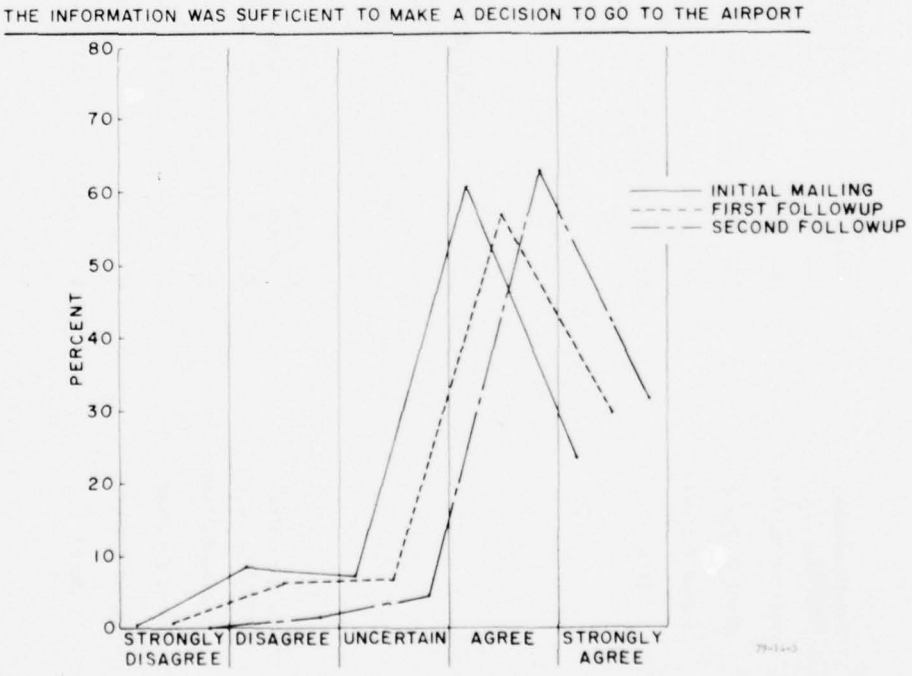


FIGURE 9. RESPONSES TO QUESTION 6b

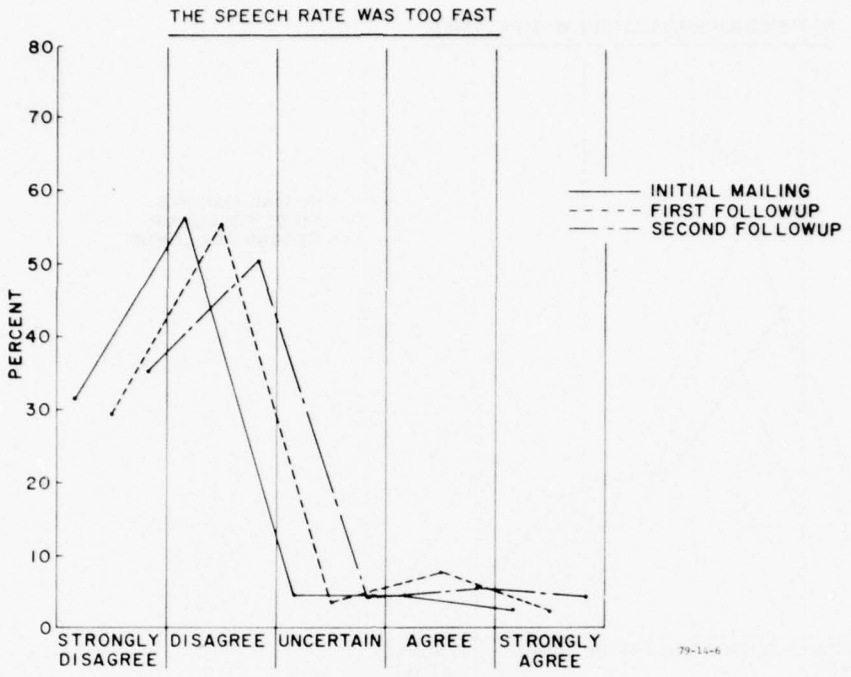


FIGURE 10. RESPONSES TO QUESTION 6c

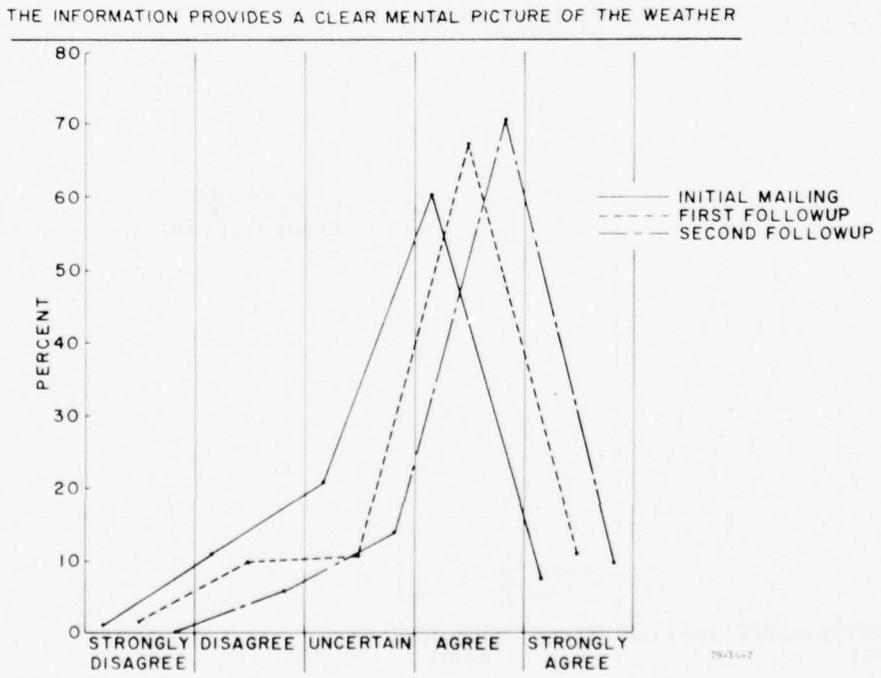


FIGURE 11. RESPONSES TO QUESTION 6d

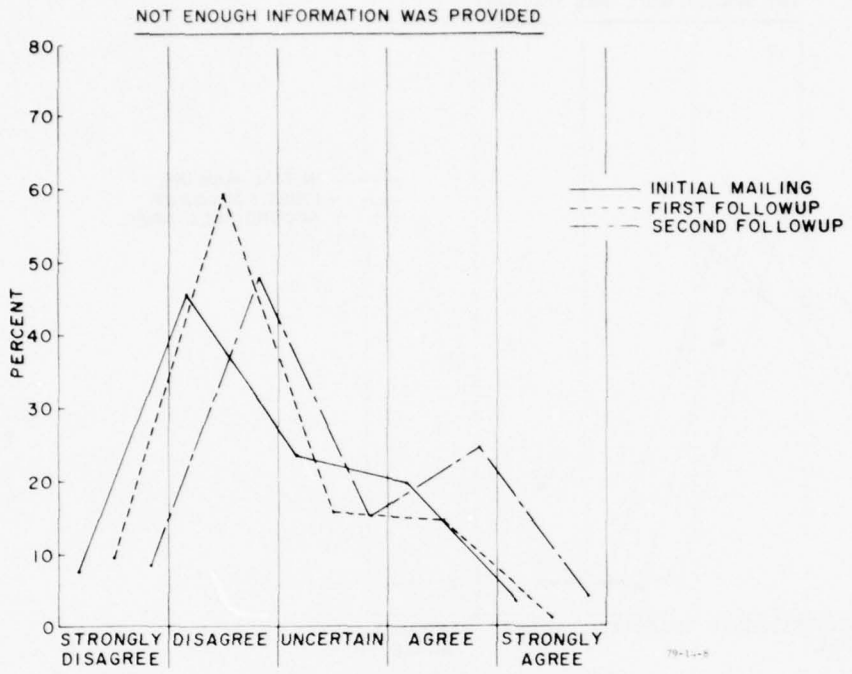


FIGURE 12. RESPONSES TO QUESTION 6e

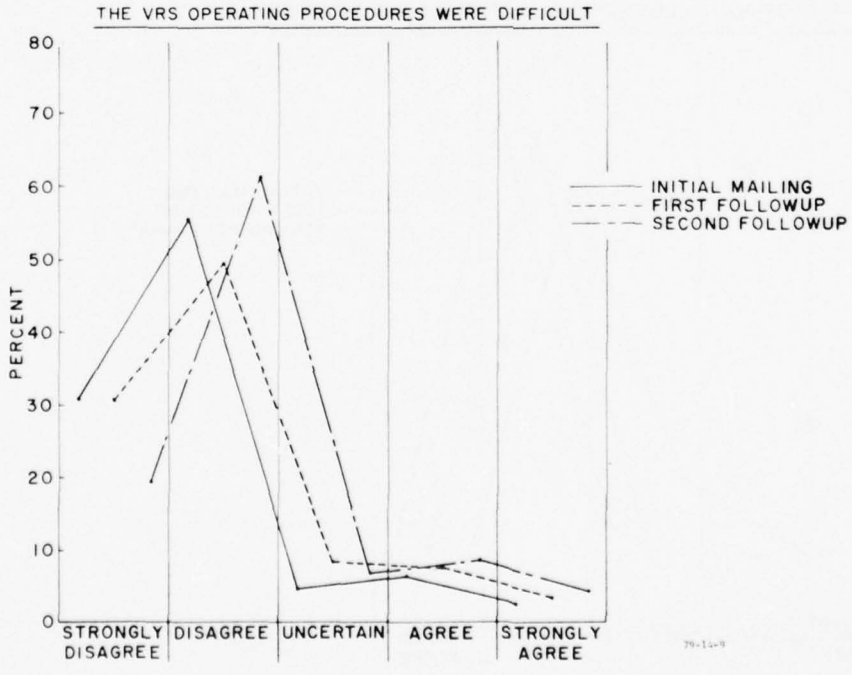


FIGURE 13. RESPONSES TO QUESTION 6f

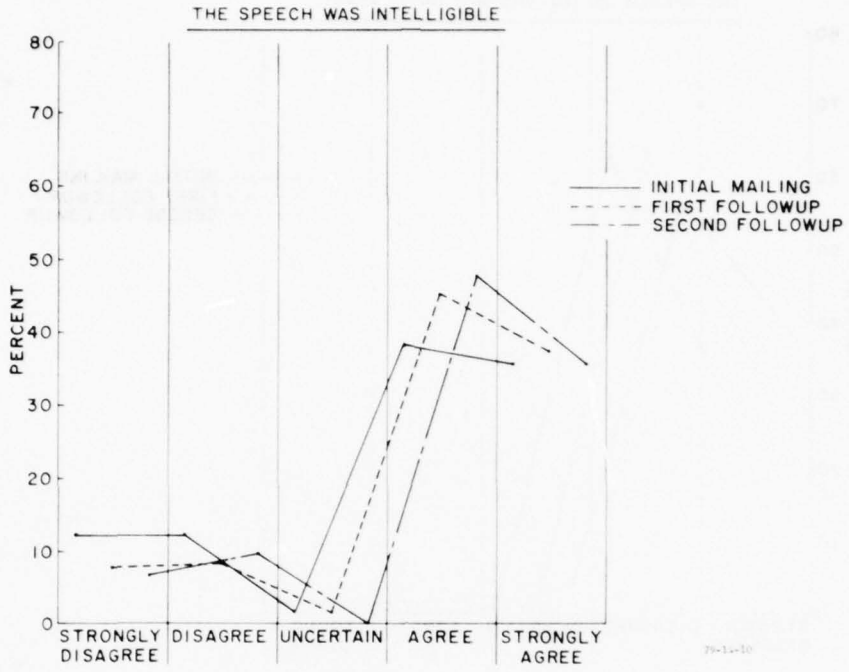


FIGURE 14. RESPONSES TO QUESTION 6g

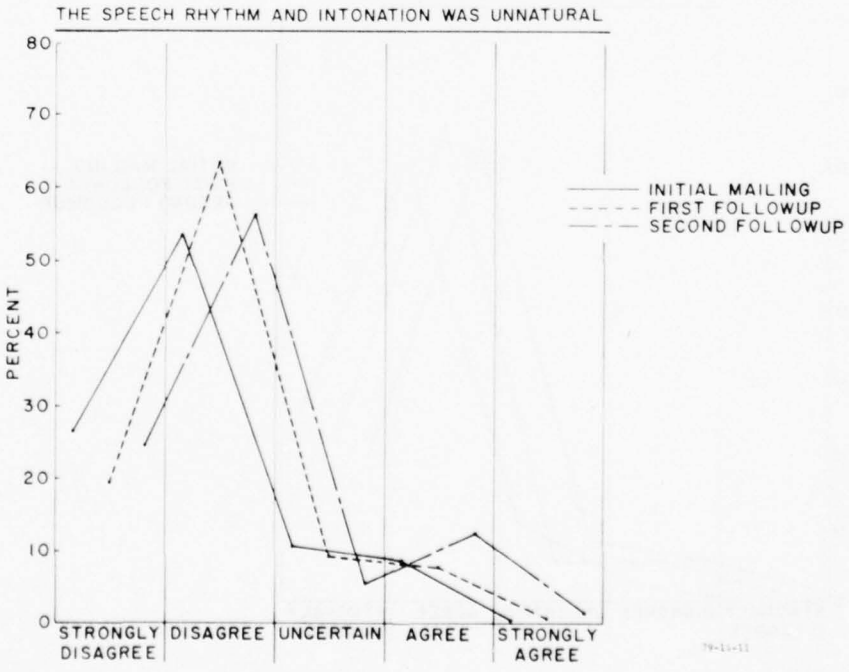


FIGURE 15. RESPONSES TO QUESTION 6h

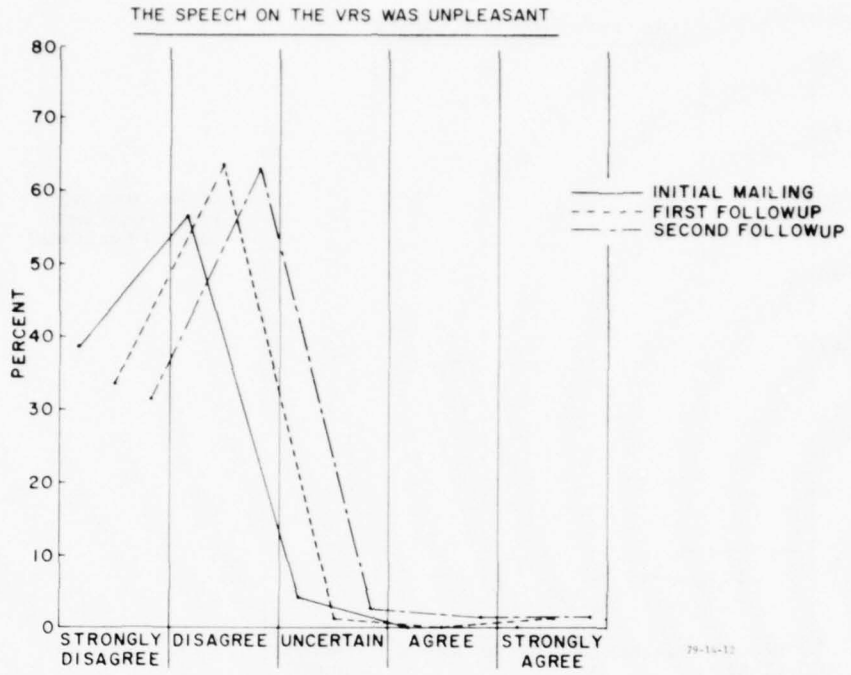


FIGURE 16. RESPONSES TO QUESTION 6i

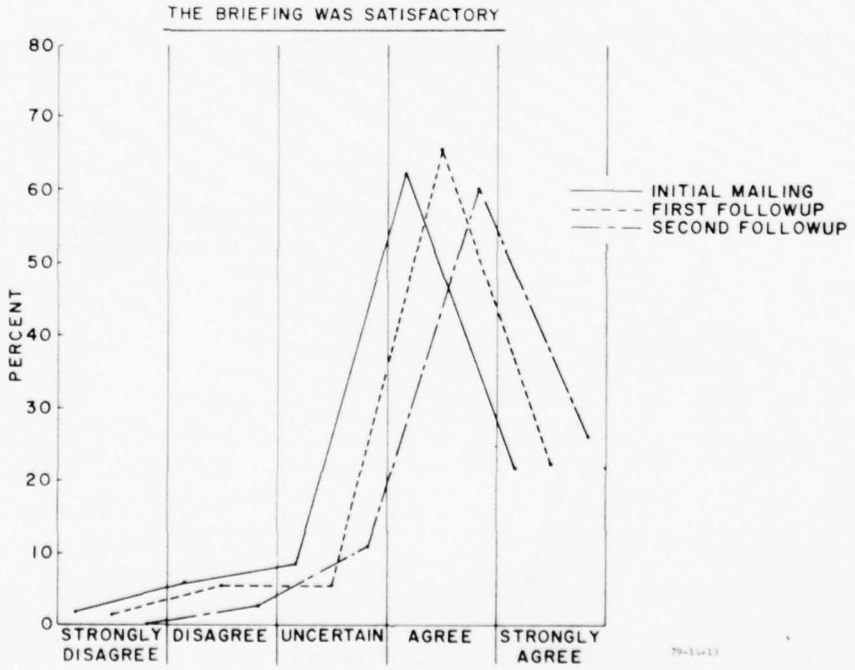


FIGURE 17. RESPONSES TO QUESTION 6j

this may detract greatly from the interest and usefulness of the study. Secondly, the randomness of the sample may be affected. The whole rationale for the chi-square test rests on the randomness of the sample and that the categories into which the observations may fall are chosen in advance. Pooling categories after the data are seen may affect the random nature of the sample, with unknown consequences. Lastly, the manner in which categories are pooled can have an important effect on the inferences drawn. The practice of combining classification categories should therefore be avoided if at all possible." In light of the above, small expected values were not combined. Instead, those classification categories that contained none or only a few responses were eliminated. A chi-square test was then made based on the categories containing the preponderance of responses.

NECESSITY FOR CONTACTING FSS AFTER VRS BRIEFING.

Tables 15 and 16 and figures 18 and 19 compare the responses obtained from the three mailings to question 7, "Did the briefing received from the VRS make it unnecessary for you to call the Flight Service Station (FSS) for weather information?" The question elicited a response for both a preflight and in-flight status. The three mailings, which covered a comparable sample of individuals, gave approximately the same results. A chi-square analysis shows that there is no statistically significant difference between the distribution of responses from the three populations.

	χ^2
Preflight	5.21
In-Flight	5.17

At the .05 level of significance, with four degrees of freedom, the null hypothesis is accepted; i,e., no significant difference.

Table 17 and figure 20 show that for preflight planning, 56.28 percent of the respondents answered "yes" to question 7, "Did the briefing received from the VRS make it unnecessary for you to call the Flight Service Station (FSS) for weather information?" Since the VRS briefing, which contained only three weather products, was not intended to be a complete weather briefing, the large number of affirmative answers to this question was unexpected. In an effort to examine this result in more depth, the responses to question 7 were categorized according to the following subgroups:

1. License
2. Rating
3. Total Flying Time

Table 18 and figure 21 show the distribution of responses to the preflight segment of question 7 by type of pilot license. A chi-square test showed that there is no statistically significant difference by license category.

TABLE 15. RESPONSES TO QUESTION 7, PREFLIGHT

FSS Uncessary after VRS Briefing

Returns	Yes		No		Uncertain		Total	
	N	%	N	%	N	%	N	%
Initial Mailing	112	53.33	82	39.05	16	7.62	210	100
First Followup	97	59.15	48	29.27	19	11.59	164	100
Second Followup	42	58.33	22	30.56	8	11.11	72	100
Total	251	56.28	152	34.08	43	9.64	446	100

TABLE 16. RESPONSES TO QUESTION 7, IN-FLIGHT

FSS Uncessary after VRS Briefing

Returns	Yes		No		Uncertain		Total	
	N	%	N	%	N	%	N	%
Initial Mailing	33	18.33	107	59.44	40	22.22	180	100
First Followup	33	23.30	71	47.97	44	29.73	148	100
Second Followup	13	22.03	34	57.63	12	20.34	59	100
Total	79	20.41	212	54.78	96	24.81	387	100

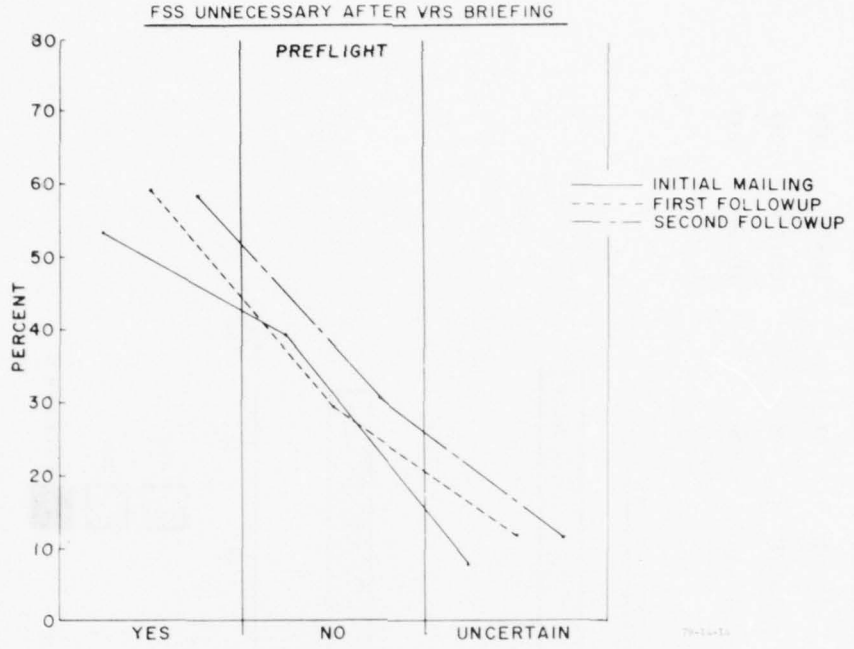


FIGURE 18. RESPONSES TO QUESTION 7, PREFLIGHT

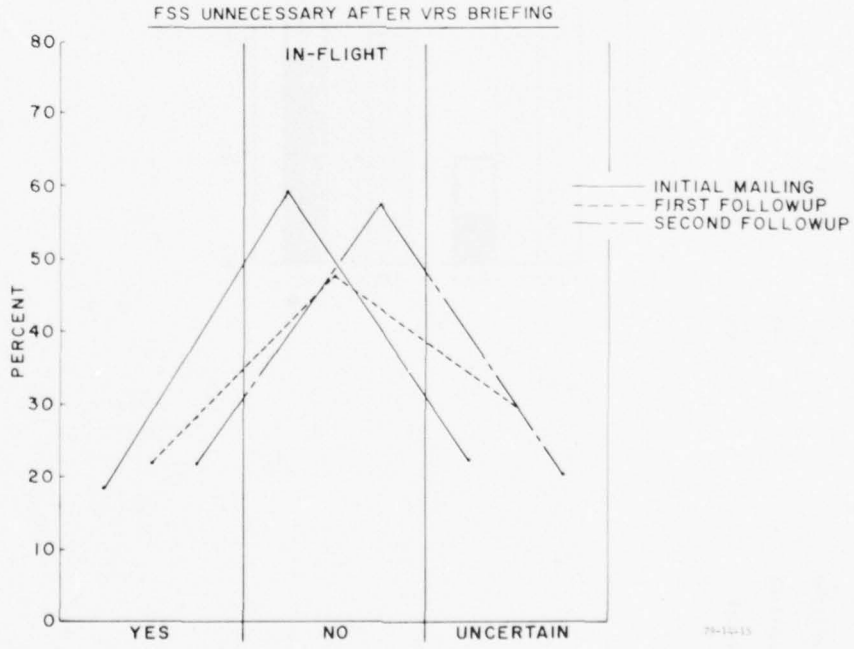


FIGURE 19. RESPONSES TO QUESTION 7, IN-FLIGHT

TABLE 17. TOTAL RESPONSES TO QUESTION 7

FSS Uncessary after VRS Briefing

	Yes		No		Uncertain		Total	
	N	%	N	%	N	%	N	%
Preflight	251	(56.28)	152	(34.08)	43	(9.64)	446	(100.00)
In-Flight	79	(20.41)	212	(54.78)	96	(24.81)	387	(100.00)
Total	330	(39.62)	364	(43.70)	139	(16.69)	833	(100.00)

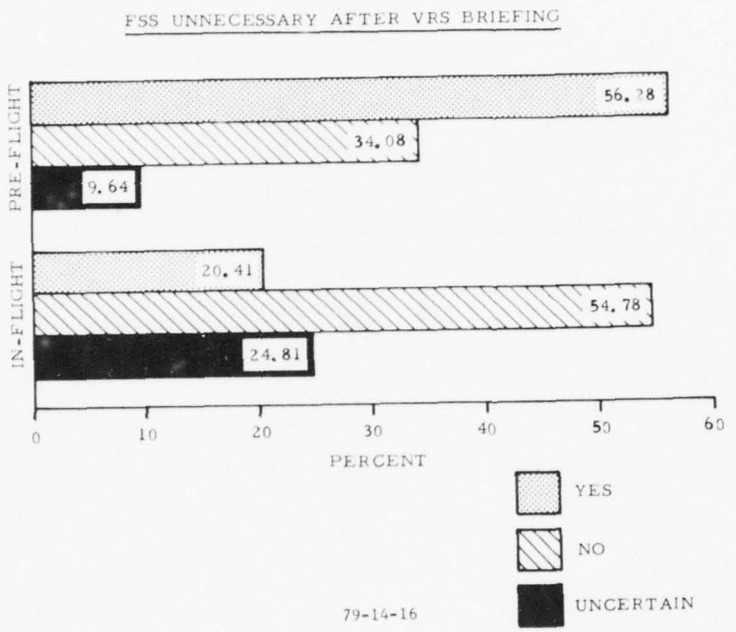


FIGURE 20. TOTAL RESPONSES TO QUESTION 7

TABLE 18. RESPONSES TO QUESTION 7, BY TYPE OF PILOT'S LICENSE, PREFLIGHT

License	FSS Unnecessary after VRS Briefing: Yes N	Yes %	No N	No %	Uncertain N	Uncertain %	Totals N	Totals %
Student	13	52.00	11	44.00	1	4.00	25	100.00
Private	115	56.37	65	31.86	24	11.76	204	100.00
Commercial	94	55.29	63	37.06	13	7.65	170	100.00
ATR	29	61.70	13	27.66	5	10.64	47	100.00
Total	251	56.28	152	34.08	43	9.64	446	100.00

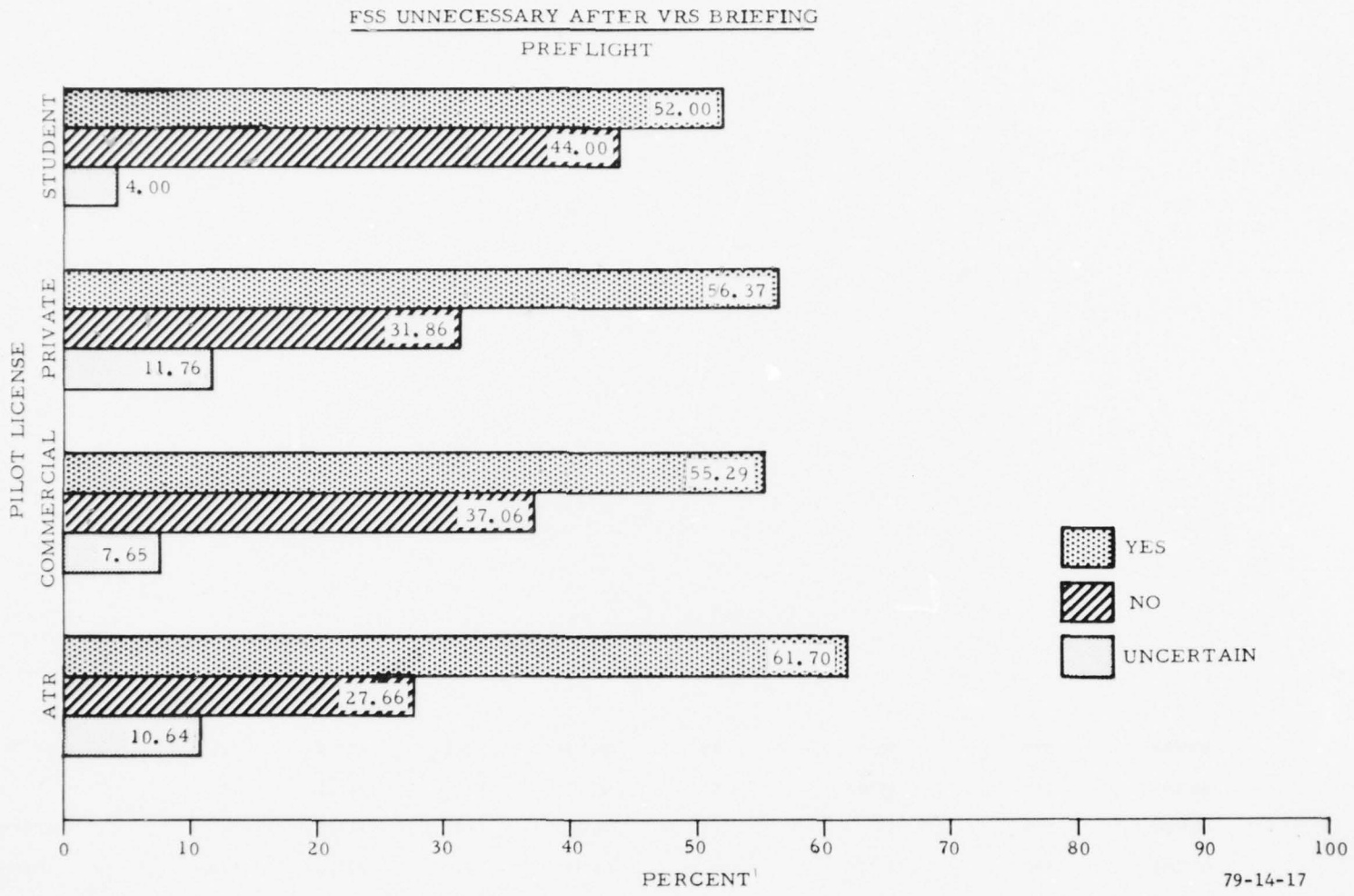


FIGURE 21. RESPONSES TO QUESTION 7 BY TYPE OF PILOT'S LICENSE, PREFLIGHT

Table 19 and figure 22 compare the distribution of responses by weather rating In this case, chi-square is equal to 4.48, which is not significant at the .05 level. The null hypothesis is accepted.

Table 20 and figure 23 show the distribution of responses by total flying time. As in the case of license category and weather rating, the result was not statistically significant. Chi-square is equal to 3.25 with 8 degrees of freedom. Thus, the unexpectedly large number of affirmative answers to question 7 (preflight) was not unduly influenced by a specific license category, weather rating, or by a given experience level.

Tables 21 and 22 compare the responses to question 8 obtained from respondents to the (1) initial mailing, (2) first followup, and (3) second followup. The three separate mailings, which covered a comparable sample of individuals, gave approximately the same results. A chi-square test showed that there is no statistically significant difference between the distribution of responses from the three populations.

$$\text{Preflight} \quad \chi^2 = 0.27$$

$$\text{In-Flight} \quad \chi^2 = 0.40$$

Table 23 indicates that over 90 percent of the respondents answered "yes" to question 8 (preflight), "If you still had to call the FSS for weather information, did the VRS briefing reduce the time on the line with the FSS?" (See figure 24). It was estimated that the VRS briefing reduced the time on line with the FSS by an average of 47.19 percent. The reduction for in-flight was not as striking but nevertheless was *quite* substantial. See figure 25 for a comparison.

READBACK METHODS FOR LOCATION IDENTIFIERS.

Table 24 shows the distribution of responses from the three mailings to question 9, "(Of the two readback methods for location identifiers, which do you prefer?)." As in all previous cases, there is no statistically significant difference between the three populations in response to question 9. The value of chi-square in this case is 2.67: therefore, the null hypothesis is accepted.

As shown in figure 26, a large majority of respondents in each of the three populations preferred the spoken name over phonetics. Figure 27 shows that a total of 80.34 percent of all respondents preferred the spoken name as compared to 19.66 percent that preferred the use of phonetics.

PERMANENT USE OF VRS.

Figure 28 depicts the overall response to question 10, "Based on your experience with the VRS, would you use it if implemented permanently?" Approximately 60 percent indicated that they would use the VRS for an overview of weather conditions. Twenty-six percent indicated that they would use it for a complete weather briefing. Since the VRS was not designed to provide the pilot with

TABLE 19. RESPONSES TO QUESTION 7, BY WEATHER RATING, PREFLIGHT

Rating	FSS Unnecessary after VRS Briefing: Yes N	Yes %	No N	No %	Uncertain N	Uncertain %	Totals N	Totals %
VFR	124	61.69	59	29.35	18	8.96	201	100.00
IFR	127	51.84	93	37.96	25	10.20	245	100.00
Total	251	56.28	152	34.08	43	9.64	446	100.00

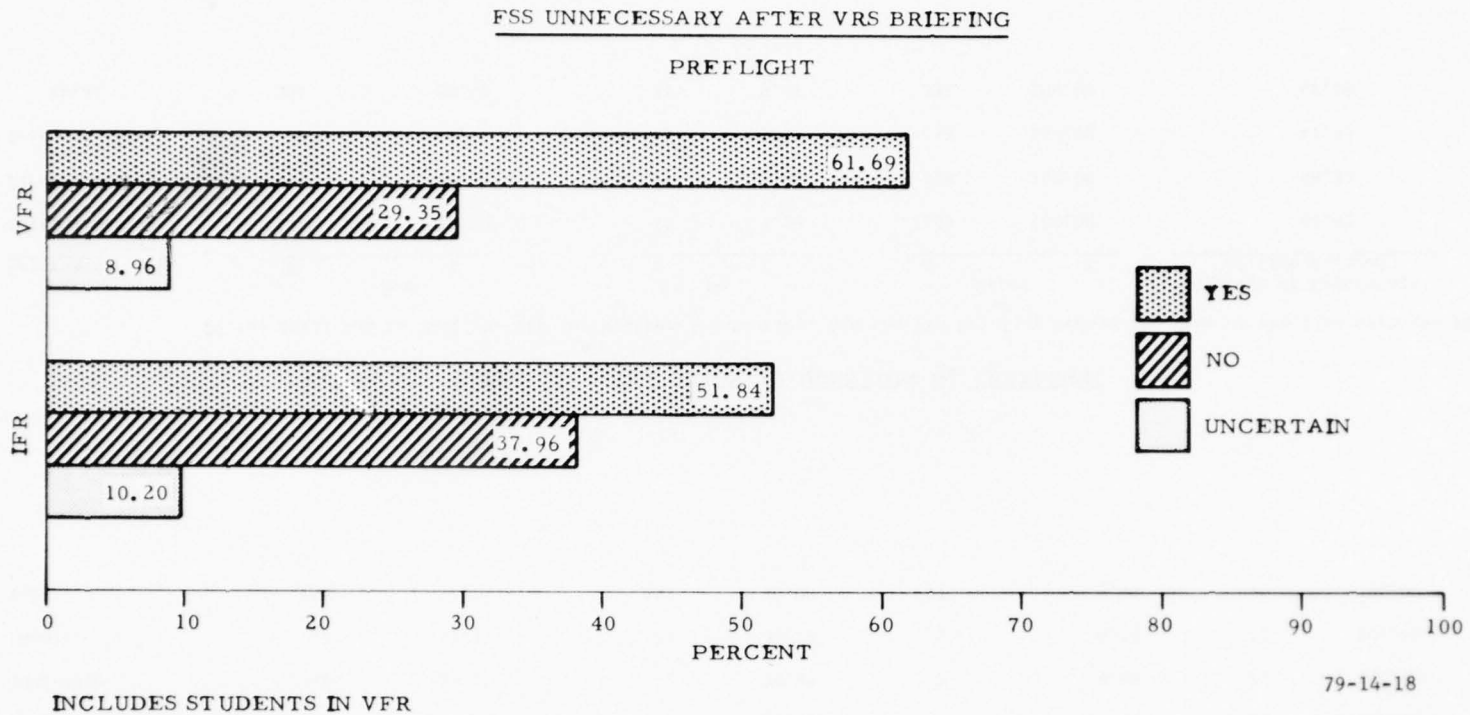


FIGURE 22. RESPONSES TO QUESTION 7, VFR AND IFR, PREFLIGHT

TABLE 20. RESPONSES TO QUESTION 7, BY PILOT TOTAL FLYING HOURS, PREFLIGHT

FSS Unnecessary after VRS Briefing

Flying Time (Hours)	Yes		No		Uncertain		Totals	
	N	%	N	%	N	%	N	%
0-160	53	59.55	26	29.21	10	11.24	89	100.00
161-800	84	52.50	61	38.13	15	9.38	160	100.00
801-1800	30	55.56	18	33.33	6	11.11	54	100.00
1801-4800	42	59.15	22	30.99	7	9.86	71	100.00
4801+	42	58.33	25	34.72	5	6.94	72	100.00
Total	251	56.28	152	34.08	43	9.64	446	100.00

TABLE 21. RESPONSES TO QUESTION 8, PREFLIGHT

If You Still Had to Call the FSS for Weather Information, Did the VRS Briefing Reduce the Time on the Line with the FSS?

Returns	Yes		No		Total		Average of Percentage of Time Reduced
	N	%	N	%	N	%	
Initial Mailing	148	90.80	15	9.20	163	100.00	47.82
First Followup	105	88.98	13	11.02	118	100.00	48.32
Second Followup	48	90.57	5	9.43	53	100.00	42.73
Total	301	90.12	33	9.88	334	100.00	47.19

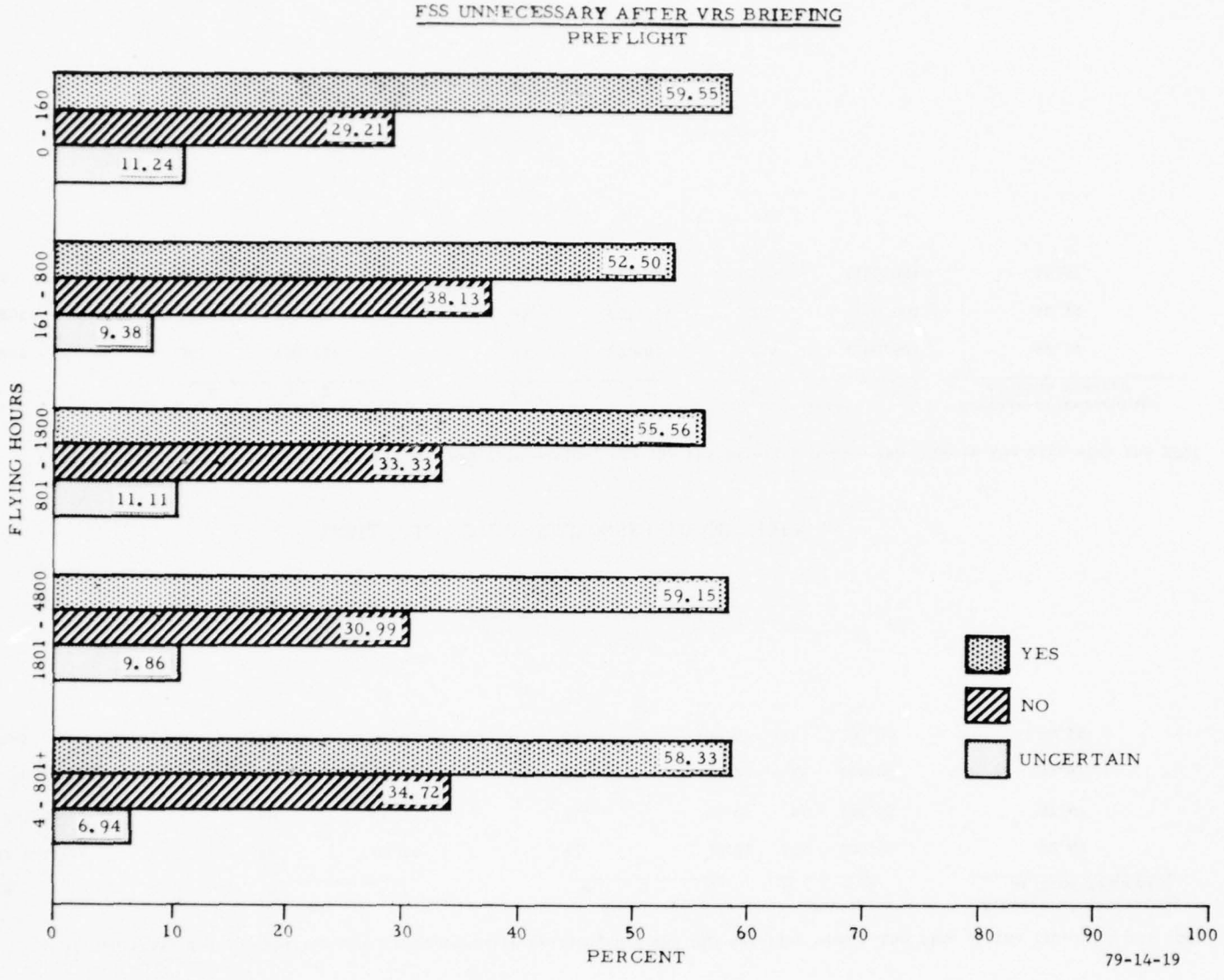


FIGURE 23. RESPONSES TO QUESTION 7 BY PILOT FLIGHT EXPERIENCE, PREFLIGHT

TABLE 22. RESPONSES TO QUESTION 8, IN-FLIGHT

If You Still Had to Call the FSS for Weather Information, Did the VRS Briefing Reduce the Time on the Line with the FSS?

Returns	Yes N	Yes %	No N	No %	Total N	Total %	Average of Percentage of Time Reduced
Initial Mailing	86	67.19	42	32.81	128	100.00	42.43
First Followup	60	65.93	31	34.07	91	100.00	37.67
Second Followup	30	71.43	12	28.57	42	100.00	38.83
Total	176	67.43	85	32.57	261	100.00	40.19

TABLE 23. TOTAL RESPONSES TO QUESTION 8

If You Still Had to Call The FSS for Weather Information, Did the VRS Briefing Reduce the Time on the Line with the FSS?

	Yes N	Yes %	No N	No %	Total N	Total %	Average of Percentage of Time Reduced
Preflight	301	(90.12)	33	(9.88)	334	(100.00)	47.19
In-Flight	176	(67.43)	85	(32.57)	261	(100.00)	40.19
Total	477	(80.17)	118	(19.83)	595	(100.00)	44.61

DID VRS BRIEFING REDUCE TIME ON LINE WITH FSS?

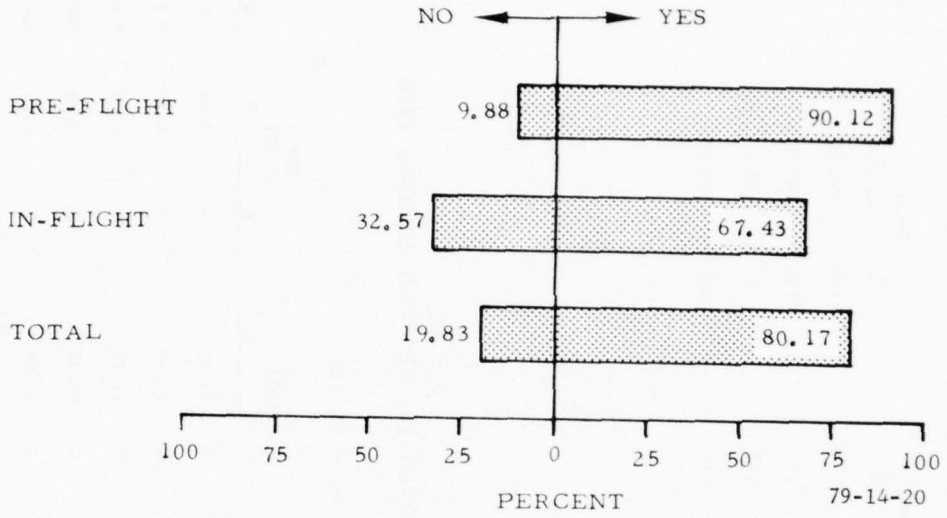


FIGURE 24. RESPONSES TO QUESTION 8 (PREFLIGHT/INFLIGHT)

AVERAGE OF PERCENT TIME REDUCED

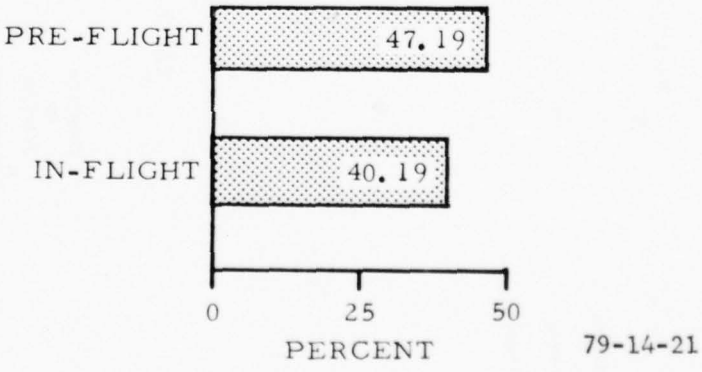


FIGURE 25. RESPONSES TO QUESTION 8 (PERCENT TIME REDUCED)

TABLE 24. RESPONSES TO QUESTION 9

Of the Two Readback Methods for Location Identifiers, Which Do You Prefer?

Returns	Phonetics N	Phonetics %	Spoken Name N	Spoken Name %	Total N	Total %
Initial Mailing	34	17.62	159	82.38	193	100.00
First Followup	29	19.21	122	80.79	151	100.00
Second Followup	17	26.98	46	73.02	63	100.00
Total	80	19.66	327	80.34	407	100.00

TABLE 25. RESPONSES TO QUESTION 10, BY PILOT LICENSE TYPE

Permanent Use of the VRS

Pilot License	Complete Wx Briefing N	Complete Wx Briefing %	Overview N	Overview %	Update N	Update %	Not At All N	Not At All %	Totals N	Totals %
Student	6	20.00	19	63.33	4	13.33	1	3.33	30	100.00
Private	63	24.32	161	62.16	32	12.36	3	1.16	259	100.00
Commercial	62	30.24	119	58.05	23	11.22	1	0.49	205	100.00
ATR	13	21.67	37	61.67	8	13.33	2	3.33	60	100.00
Totals	144	25.99	336	60.65	67	12.09	7	1.26	554	100.00

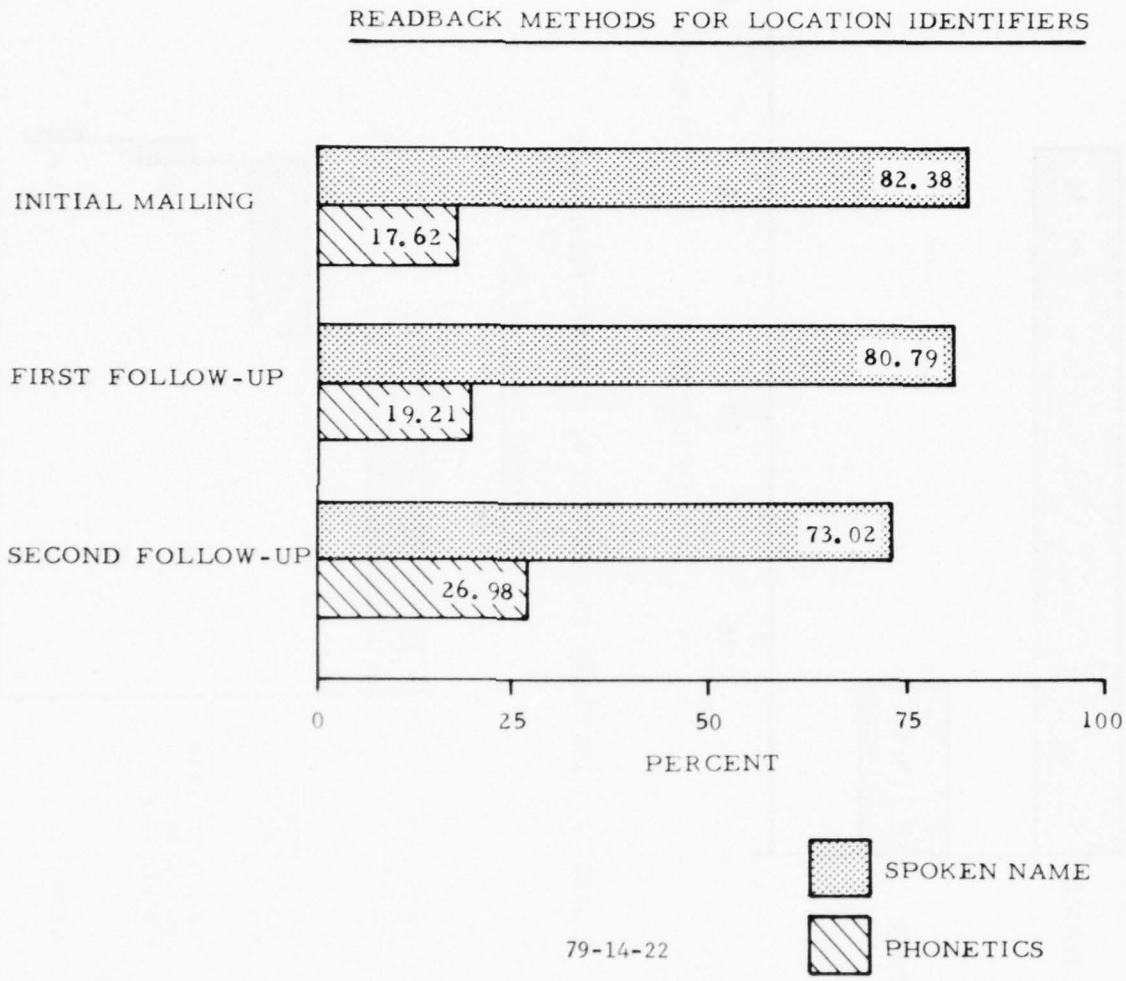


FIGURE 26. RESPONSES TO QUESTION 9

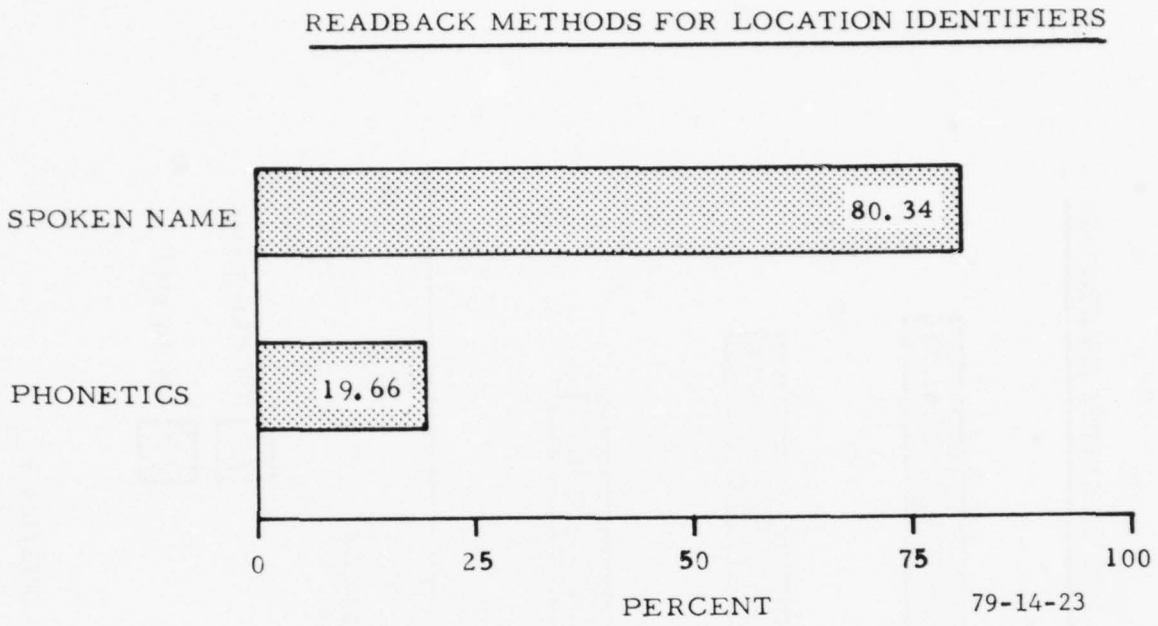


FIGURE 27. RESPONSES TO QUESTION 9, COMBINED PREFERENCE

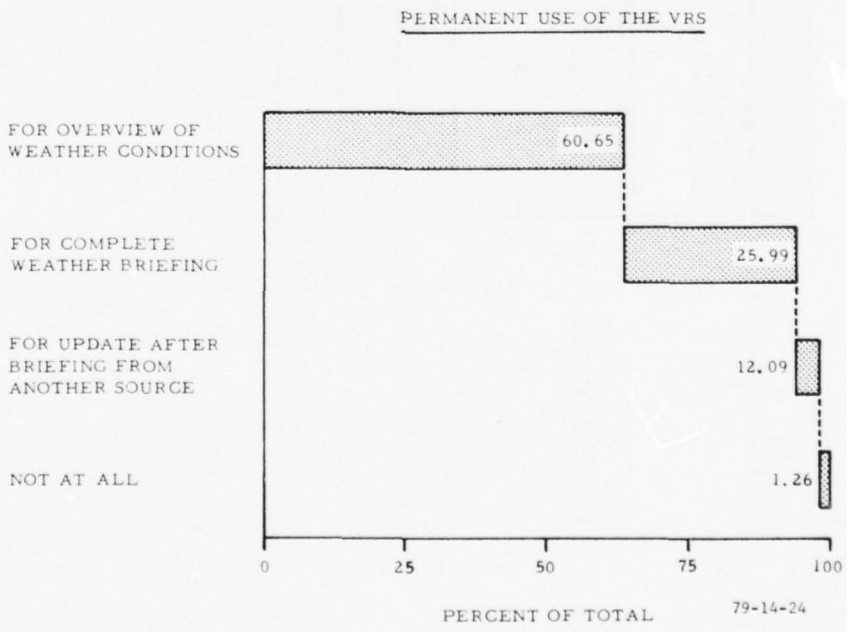


FIGURE 28. OVERALL RESPONSES TO QUESTION 10

a complete weather briefing, this result was unexpected. In an effort to examine the 26-percent figure in more detail, the responses to question 10 were categorized according to the following subgroups:

1. License,
2. Rating,
3. Total Flying Time, and
4. Number of Times VRS Used

Table 25 and figure 29 show the distribution of responses to question 10 by type of pilot license. A chi-square test showed that there was no statistically significant difference by license category. The same result was achieved for weather rating, flying time, and levels of VRS usage. Table 26 and figure 30 compare VFR and IFR. A comparison of responses by total flying time is shown in table 27 and figure 31.

A comparison between those respondents that used the VRS 10 or less times and those that used the system more than 10 times is shown in table 28 and figure 32. The findings show that the unexpected 26 percent who indicated that they would use the VRS for a complete weather briefing did not comprise a disproportionate number of a given license category, weather rating, experience level or VRS usage level.

Table 29 and figure 33 show the distribution of responses to question 10 from the initial mailing, first followup, and second followup. It is apparent that each population responded similarly. A chi-square test confirmed that the three populations could be combined.

SUITABILITY OF VRS FOR WIDESPREAD PUBLIC USE.

Figure 34 shows the overall response to question 11 of the VRS questionnaire, "Suitability of the VRS for wide-spread public use." Approximately 54 percent of the respondents indicated that the VRS was "Suitable, minor changes desirable." Thirty-nine percent indicated that the VRS was "Suitable, as is." Thus, a total of 93 percent (92.87 percent) of the respondents to question 11 indicated that the VRS is either suitable as is or suitable with minor changes. However, an examination of the data shows that 16.67 percent of the ATR pilots (9 out of 54) indicated that the VRS is either unsuitable or requires major changes. This percentage is higher than all other license categories combined as shown as follows:

License	VRS Unsuitable or Requires Major Changes	
Students	0%	(0 out of 24)
Private	7.04%	(14 out of 199)
Commercial	5.23%	(9 out of 172)
ATR	16.67%	(9 out of 54)

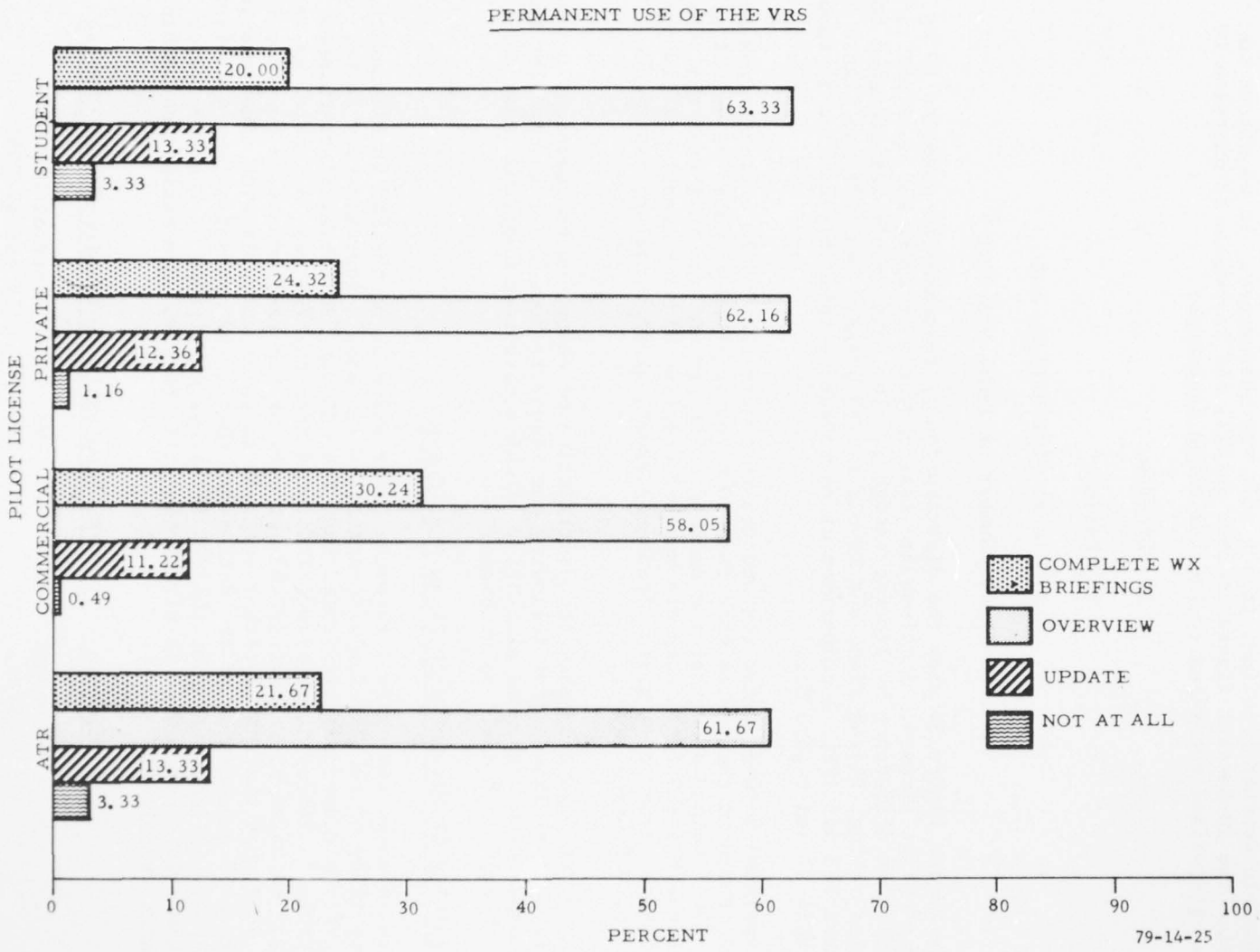


FIGURE 29. RESPONSES TO QUESTION 10, BY PILOT LICENSE TYPE

TABLE 26. RESPONSES TO QUESTION 10, BY WEATHER RATING

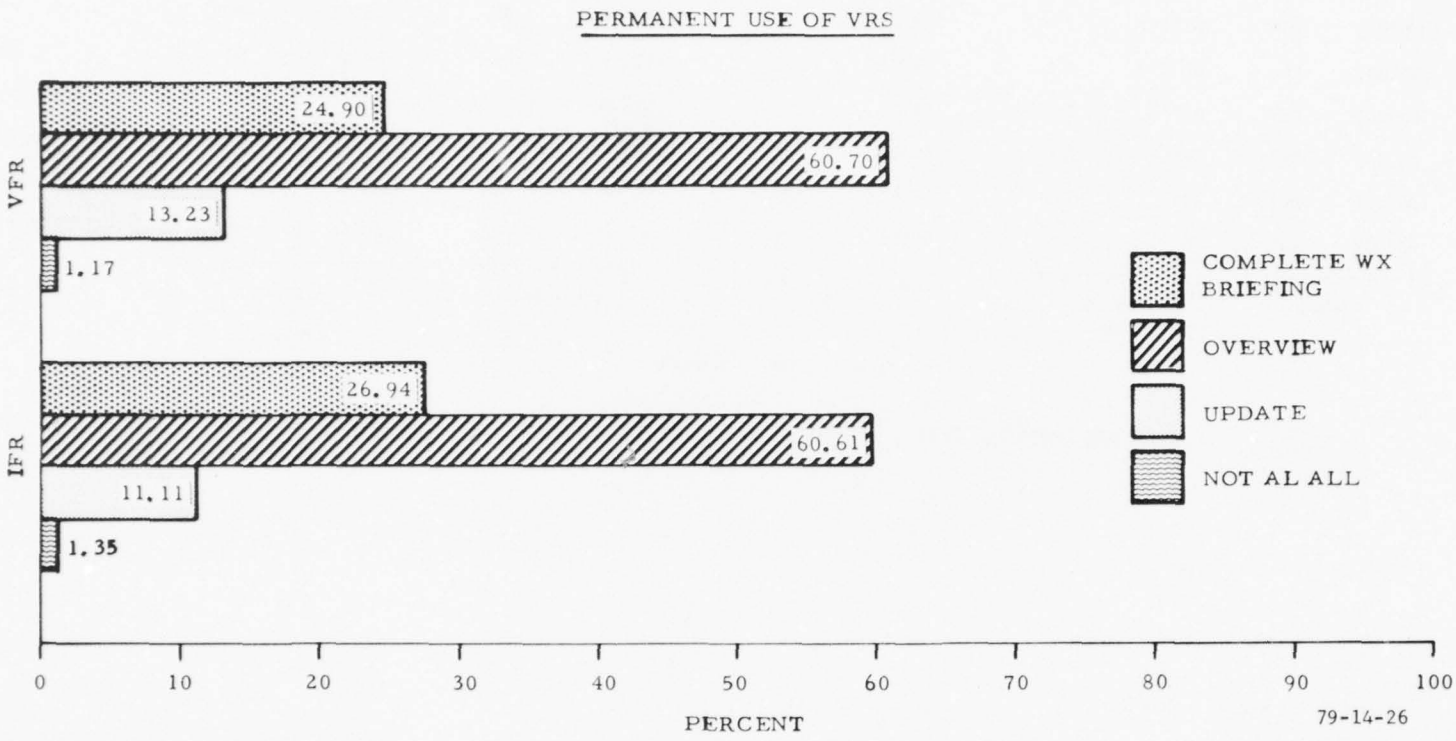
Permanent Use of the VRS

RATING	Complete Wx Briefing N	%	Overview N	%	Update N	%	Not At All N	%	Totals N	%
VFR	64	24.90	156	60.70	34	13.23	3	1.17	257	100.00
IFR	80	26.94	180	60.61	33	11.11	4	1.35	297	100.00
Total	144	25.99	336	60.65	67	12.09	7	1.26	554	100.00

TABLE 27. RESPONSES TO QUESTION 10, BY TOTAL FLYING HOURS

Permanent Use of the VRS

Flying Hours	Complete Wx Briefing N	%	Overview N	%	Update N	%	Not At All N	%	Totals N	%
0-160	28	25.00	70	62.50	14	12.50	0	0	112	100.00
161-800	49	24.62	120	60.30	28	14.07	2	1.01	199	100.00
801-1800	19	28.79	38	57.58	7	10.61	2	3.03	66	100.00
1801-4800	23	27.71	51	61.45	8	9.64	1	1.20	83	100.00
4801+	25	26.60	57	60.64	10	10.64	2	2.13	94	100.00
Totals	144	25.99	336	60.65	67	12.09	7	1.26	554	100.00



INCLUDES STUDENTS IN VFR
INCLUDES ATR IN IFR

FIGURE 30. RESPONSES TO QUESTION 10, IFR AND VFR

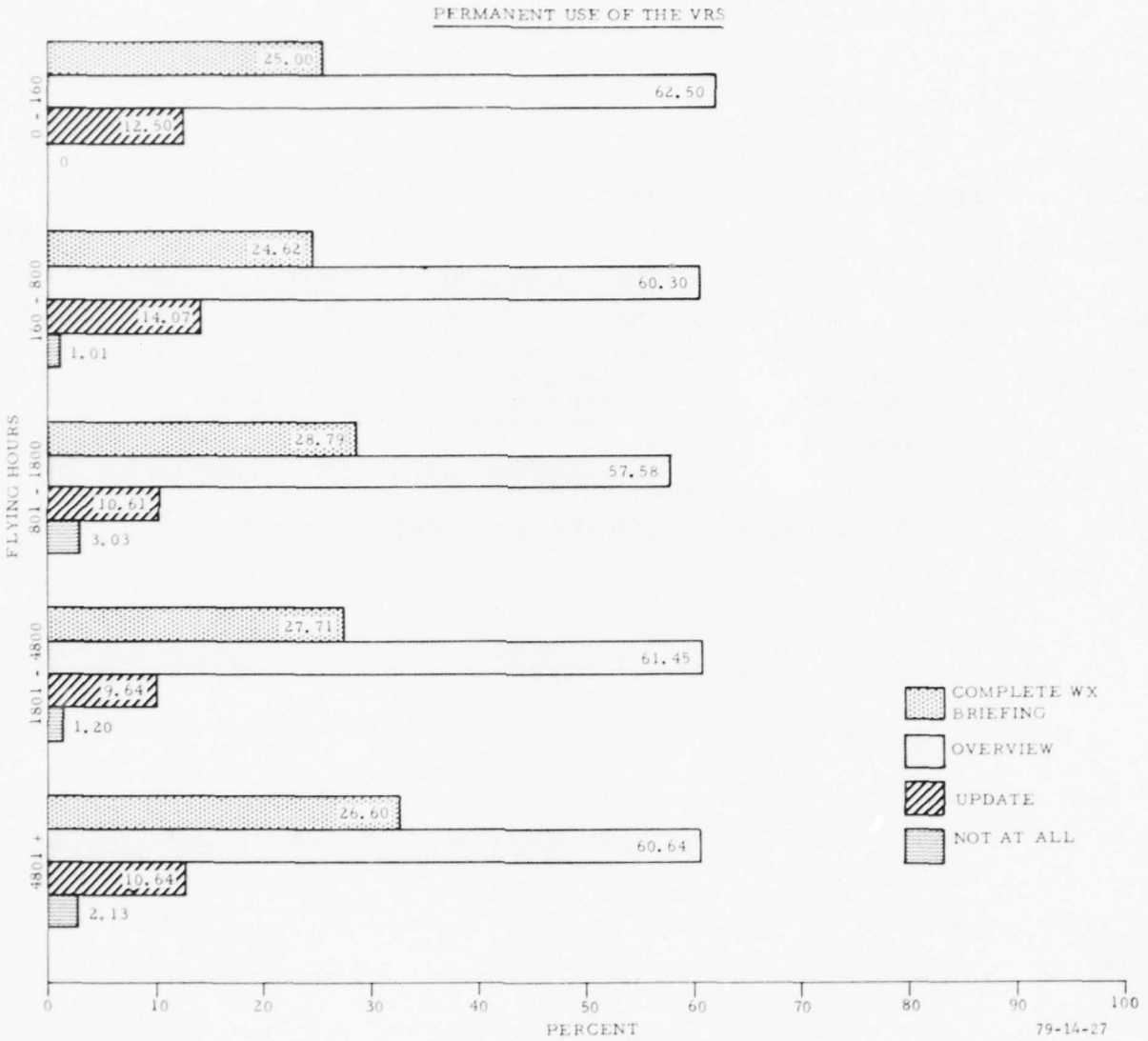


FIGURE 31. RESPONSES TO QUESTION 10, BY PILOT TOTAL FLYING HOURS

TABLE 28. RESPONSES TO QUESTION 10, UNDER VERSUS OVER 10 TIMES USED

Permanent Use of the VRS

Number of Times VRS Used	For an Complete Weather Briefing		For an Overview of the Weather Conditions		For an Update after a Briefing from Another Source		Not At All		Total	
	N	%	N	%	N	%	N	%	N	%
Less than or equal to 10	88	27.16	193	59.57	42	12.96	1	0.31	324	100.00
More than 10	46	26.14	113	64.20	17	9.66	0	0	176	100.00
Total	134	26.80	306	61.20	59	11.80	1	0.20	500*	100.00

*Includes only the respondents who indicated the number of times they used the VRS.

TABLE 29. RESPONSES TO QUESTION 10, BY MAILING SAMPLE

Permanent Use of the VRS

Questionnaire Returns	For an Complete Weather Briefing		For an Overview of the weather Conditions		For an Update after a Briefing from Another Source		Not At All		Total	
	N	%	N	%	N	%	N	%	N	%
Initial Mailing	59	22.18	169	63.53	37	13.91	1	0.38	266	100.00
First Followup	61	30.20	115	56.93	22	10.89	4	1.98	202	100.00
Second Followup	24	27.91	52	60.47	8	9.30	2	2.33	86	100.00
Total	144	25.99	336	60.65	67	12.09	7	1.26	554	100.00

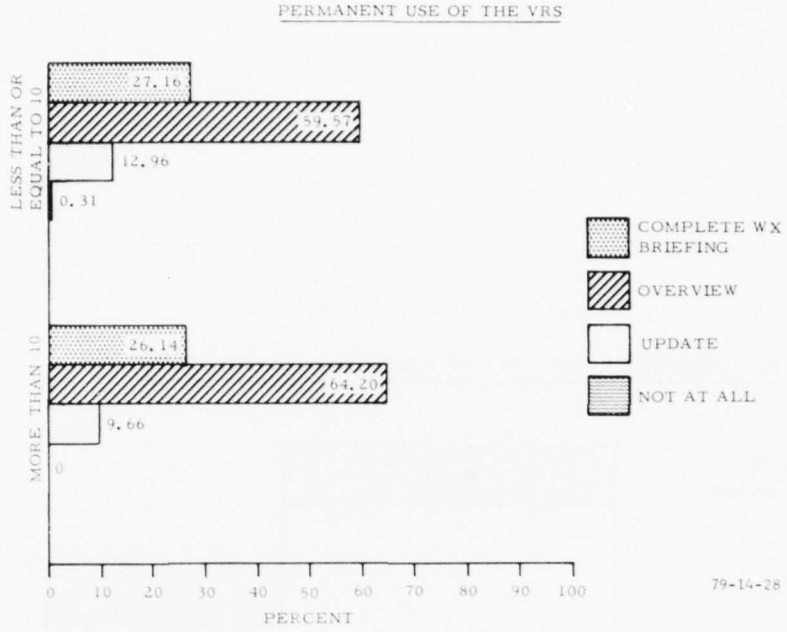


FIGURE 32. RESPONSES TO QUESTION 10, OVER VERSUS UNDER 10 TIMES USED

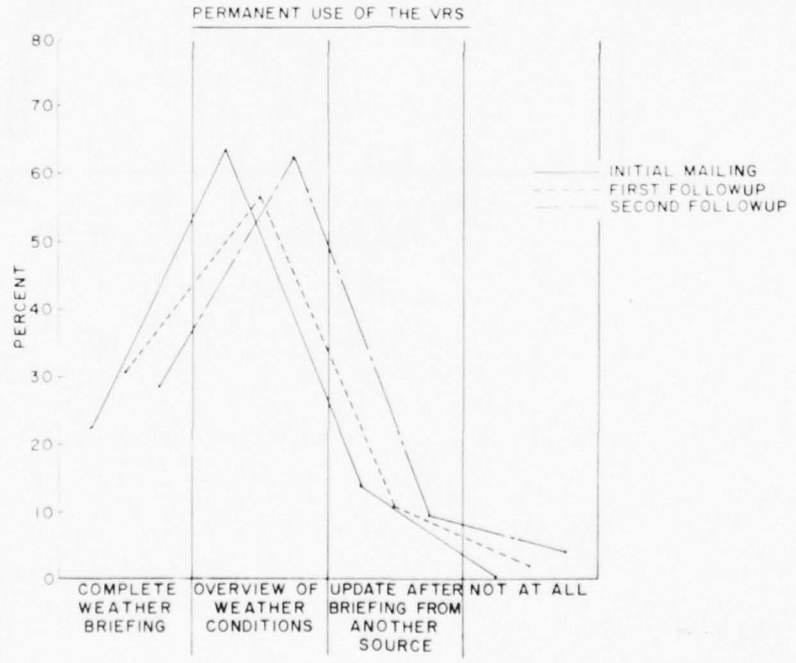


FIGURE 33. RESPONSES TO QUESTION 10 BY MAILING SAMPLE

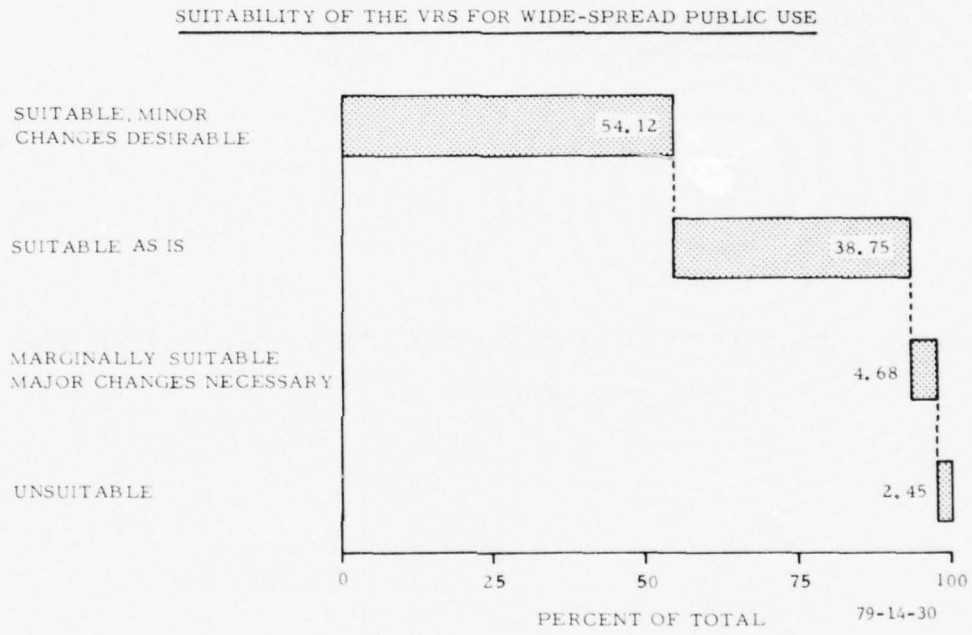


FIGURE 34. OVERALL RESPONSES TO QUESTION 11

A further examination of the data reveals that 16.25 percent of the pilots (13 out of 80) with more than 4,800 hours of total flight time indicated that the VRS is either unsuitable or requires major changes.

Flying Hours	VRS Unsuitable or Requires Major Changes	
0-160	3.37%	(3 out of 89)
161-800	7.69%	(12 out of 156)
801-1800	3.70%	(2 out of 54)
1801-4800	2.86%	(2 out of 70)
4081+	16.25%	(13 out of 80)

Table 30 and figure 35 show the distribution of responses to question 11 by type of pilot license. Table 31 and figure 36 compare the responses to question 11 by weather rating. A comparison of responses by flying time is shown in table 32 and figure 37. Table 33 and figure 38 show a comparison between two levels of VRS usage ($\leq$ 10 vs. >10). Table 34 and figure 39 show the distribution of responses to question 11 by individual mailing. It is apparent that each population responded similarly, which has consistently been the case. A chi-square test confirmed that the results of the three populations could be combined.

WRITE-IN COMMENTS.

Item 12 of the VRS questionnaire invited respondents to write in any comments they wished to express regarding the VRS. Figure 40 provides a frequency distribution of the write-in comments. Comments received in item 12 were placed in one or more of the categories shown in figure 40. The number of times a given type of comment occurred is also shown. Complimentary remarks about the VRS constituted the most frequent comment received. This type of comment occurred 227 times. A given respondent may have, in item 12, commended the system, suggested the addition of a synopsis, and noted that he prefers plain language to phonetics. In such a case, his remarks would have been divided into three catagories as follows:

Commending the system	1
Add synopsis of weather	1
Prefer plain language to phonetics	1

The system of assigning verbal output to various categories is the principal procedure used in content analysis. Content analysis is defined as a "a method of studying and analyzing communications in a systematic, objective, and quantitative manner for the purpose of measuring variables." (See Kerlinger, reference 4).

The following statements are a sample of the types of comments falling into six selected categories.

COMMENDING THE SYSTEM. "Much easier to use the VRS for periodic checks of current conditions rather than waiting long times to talk to FSS briefers."

TABLE 30. RESPONSES TO QUESTION 11, BY PILOT LICENSE TYPE

Pilot License	Suitability of VRS for Widespread Public Use: Suitable As Is N	%	Minor Changes N	%	Major Changes N	%	Unsuitable N	%	Total N	%
Student	12	50.0	12	50.0	0	0	0	0	24	100.00
Private	81	40.70	104	52.26	10	5.03	4	2.01	199	100.00
Commercial	59	34.30	104	60.47	7	4.07	2	1.16	172	100.00
ATR	22	40.74	23	42.59	4	7.41	5	9.26	54	100.00
Total	174	38.75	243	54.12	21	4.68	11	2.45	449	100.00

TABLE 31. RESPONSES TO QUESTION 11, BY WEATHER RATING

RATING	Suitability of VRS for Widespread Public Use: Suitable As Is N	%	Minor Changes N	%	Major Changes N	%	Unsuitable N	%	Total N	%
VFR	81	41.12	105	53.30	7	3.55	4	2.03	197	100.00
IFR	93	36.90	138	54.76	14	5.56	7	2.78	252	100.00
Total	174	38.75	243	54.12	21	4.68	11	2.45	449	100.00

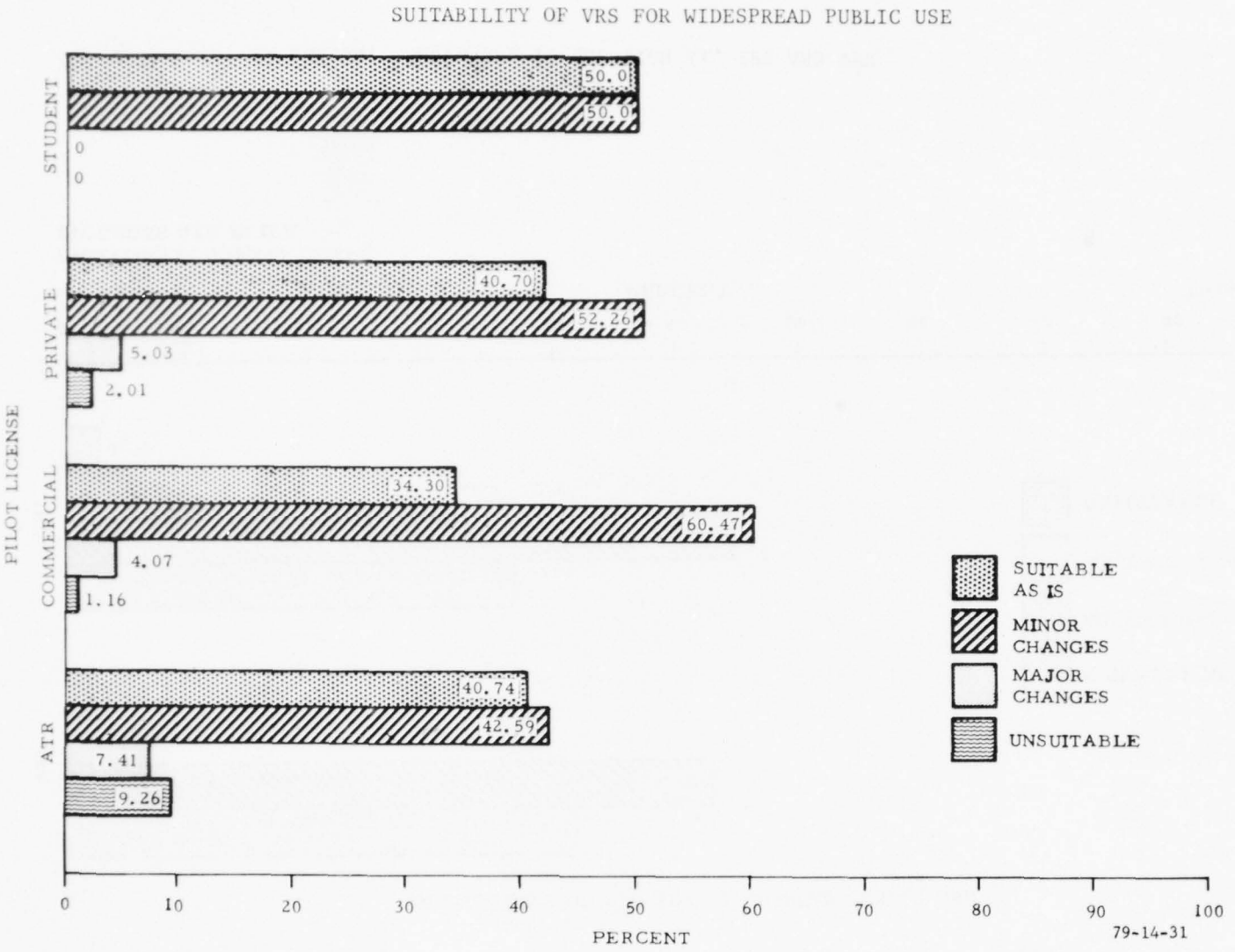


FIGURE 35. RESPONSES TO QUESTION 11 BY PILOT LICENSE TYPE

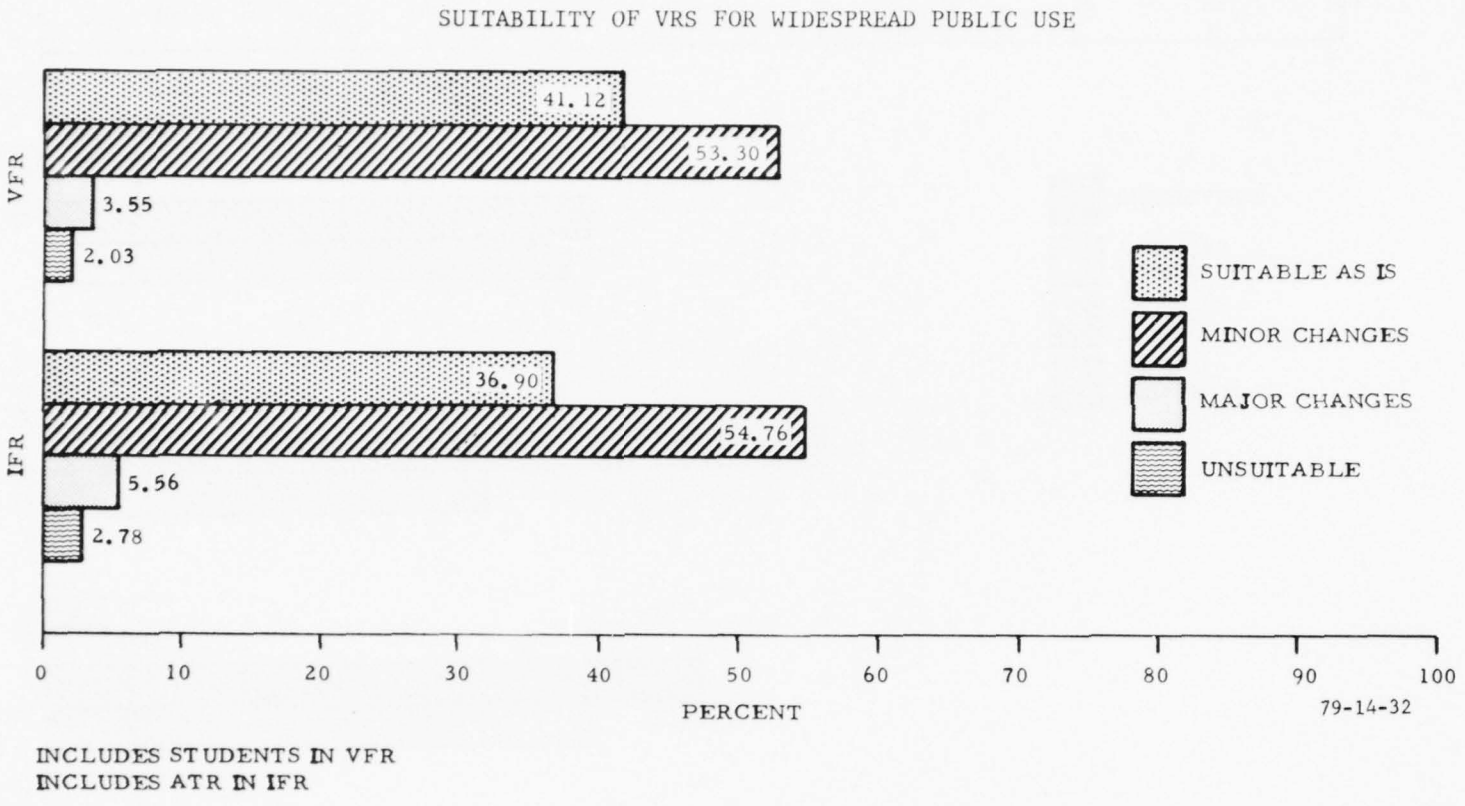


FIGURE 36. RESPONSES TO QUESTION 11, IFR AND VFR

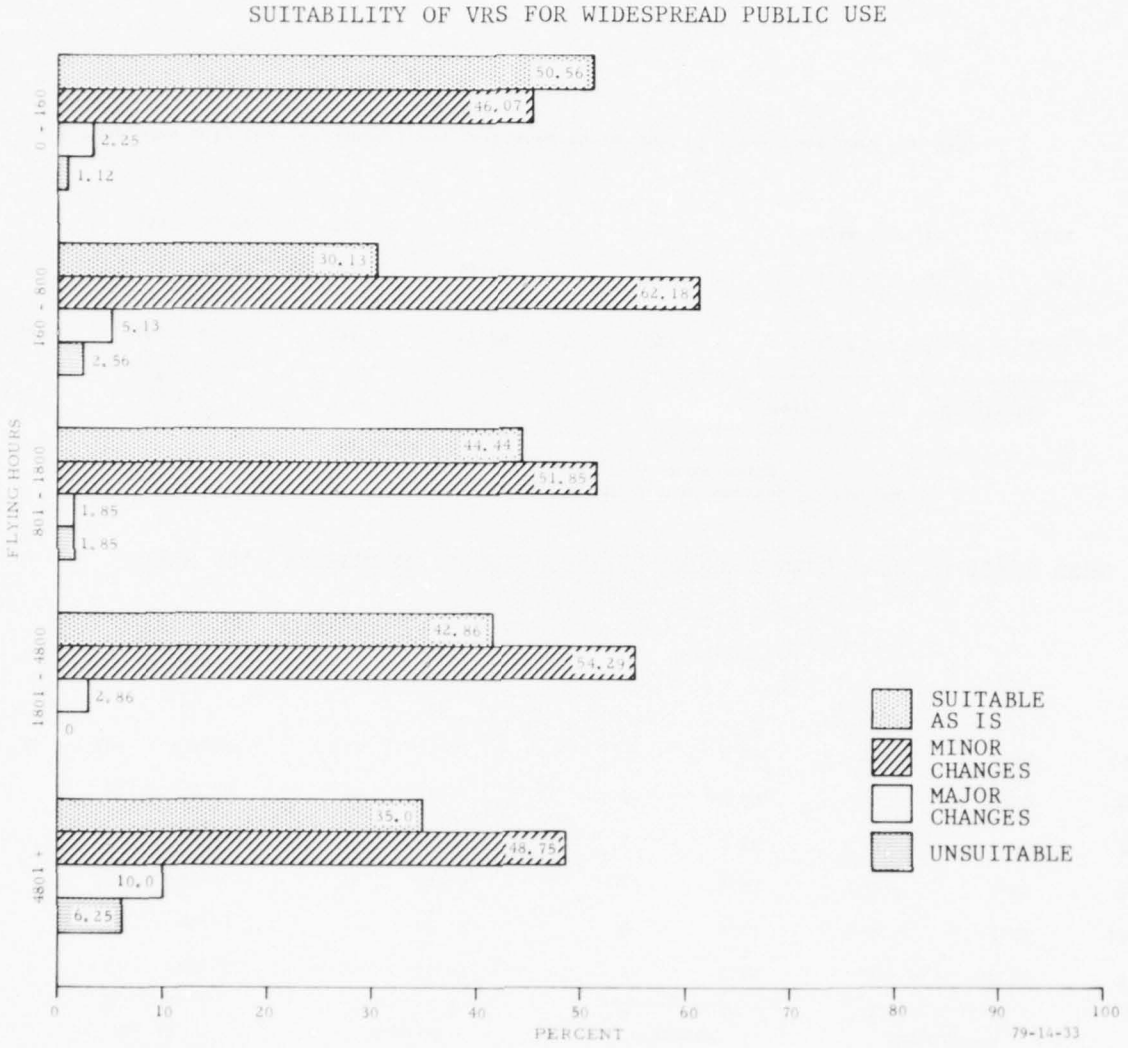


FIGURE 37. RESPONSES TO QUESTION 11 BY PILOT TOTAL FLYING TIME

TABLE 32. RESPONSES TO QUESTION 11, BY TOTAL FLYING HOURS

Flying Hours	Suitability of VRS for Widespread Public Use: Suitable As Is N	%	Minor Changes N	%	Major Changes N	%	Unsuitable N	%	Total N	%
0-160	45	50.56	41	46.07	2	2.25	1	1.12	89	100.00
161-800	47	30.13	97	62.18	8	5.13	4	2.56	156	100.00
801-1800	24	44.44	28	51.85	1	1.85	1	1.85	54	100.00
1801-4800	30	42.86	38	54.29	2	2.86	0	0	70	100.00
4801+	28	35.00	39	48.75	8	10.00	5	6.25	80	100.00
Totals	174	38.75	243	54.12	21	4.68	11	2.45	449	100.00

TABLE 33. RESPONSES TO QUESTION 11, UNDER VERSUS OVER 10 TIMES USED

Number of Times VRS Used	Suitability of the VRS for Widespread Public Use: Suitable As Is N	%	Suitable Minor Changes Disirable N	%	Marginally Suitable Major Changes Necessary N	%	Unsuitable N	%	Total N	%
Less than or equal to 10	108	41.22	137	52.29	10	3.82	7	2.67	262	100.00
More than 10	51	34.93	90	61.64	5	3.42	0	0	146	100.00
Total	159	38.97	227	55.64	15	3.68	7	1.72	408*	100.00

*Includes only the respondents who indicated the number of times they used the VRS.

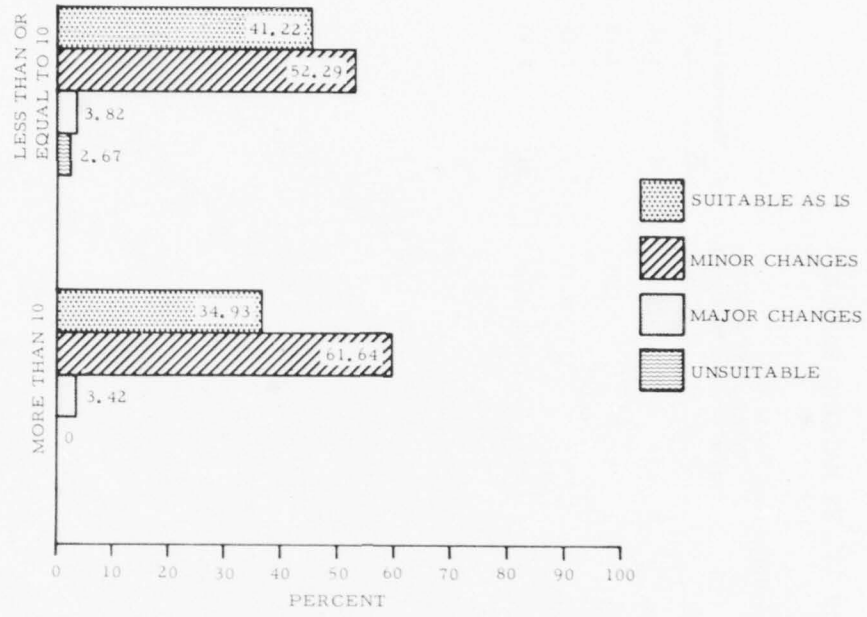


FIGURE 38. RESPONSES TO QUESTION 11, OVER VERSUS UNDER 10 TIMES USED

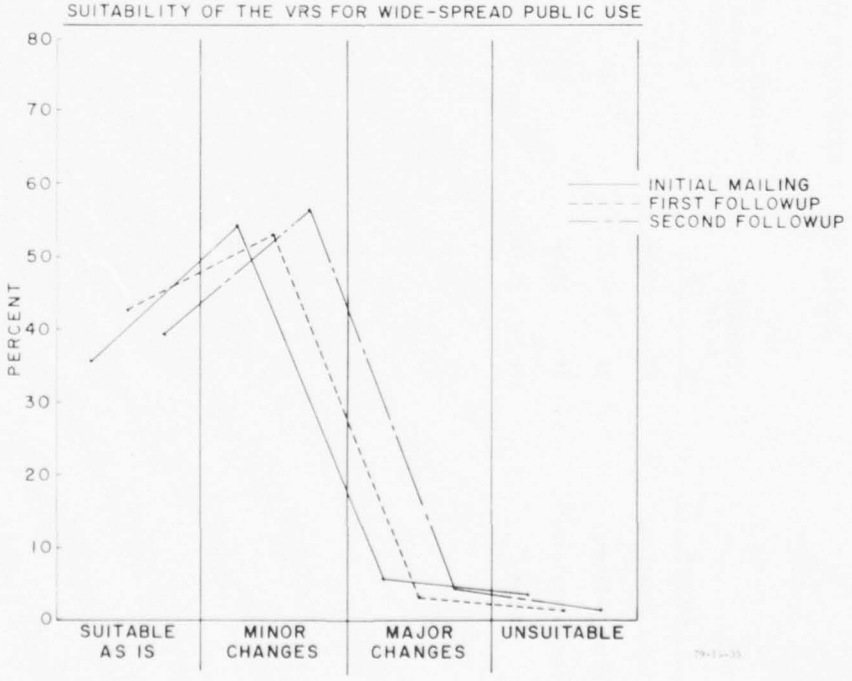


FIGURE 39. RESPONSES TO QUESTION 11 BY MAILING SAMPLE

TABLE 34. RESPONSES TO QUESTION 11, BY MAILING SAMPLE

Returns	Suitability of the VRS for Widespread Public Use: Suitable As Is N	%	Suitable, Minor Changes Desirable N	%	Marginally, Suitable Major Changes Necessary N	%	Unsuitable N	%	Total N	%
Initial Mailing	77	35.98	116	54.21	13	6.07	8	3.74	214	100.00
First Followup	71	42.77	88	53.01	5	3.01	2	1.20	166	100.00
Second Followup	26	37.68	39	56.52	3	4.35	1	1.45	69	100.00
Total	174	38.75	243	54.12	21	4.68	11	2.45	449	100.00

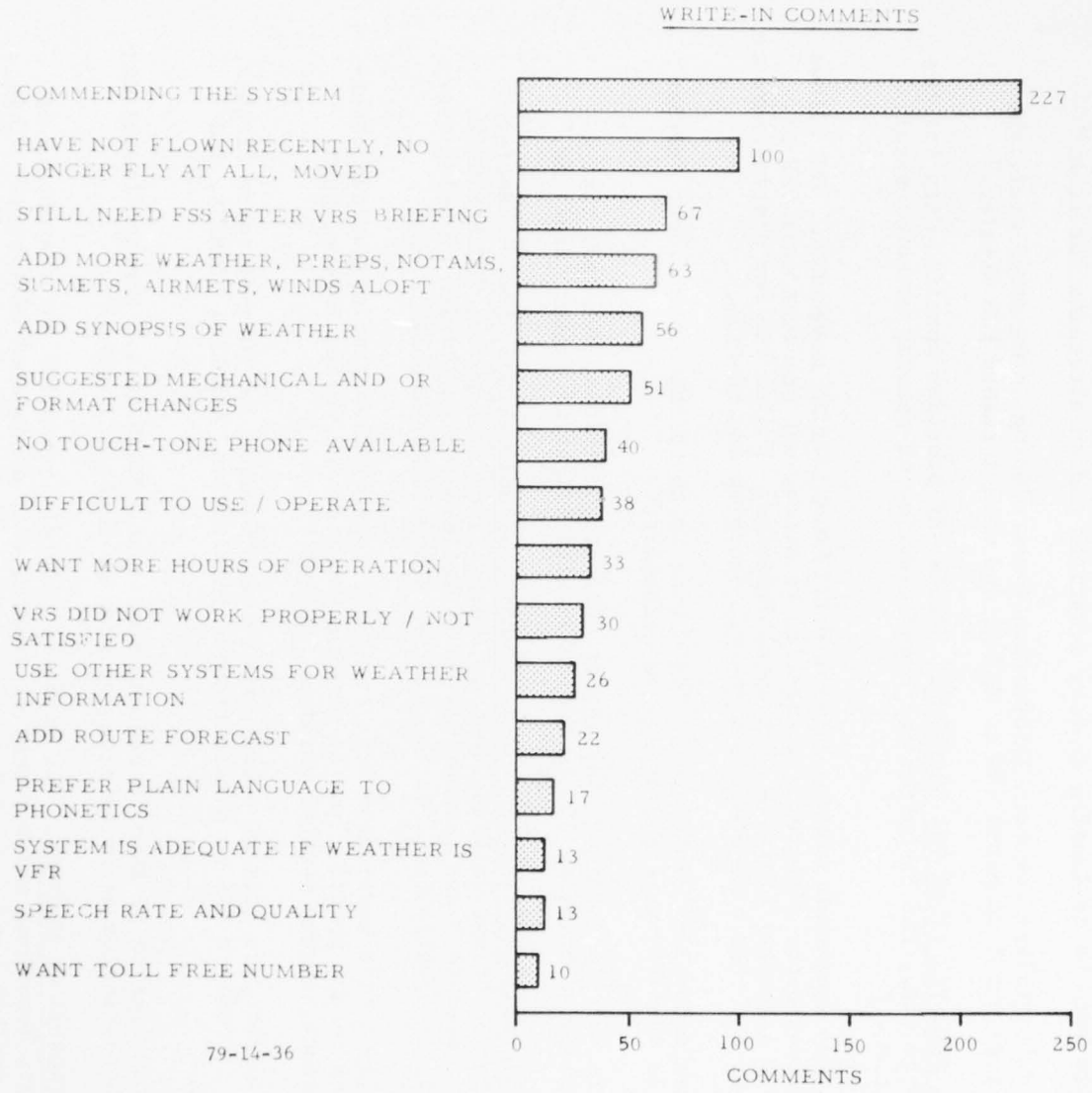


FIGURE 40. FREQUENCY DISTRIBUTION OF VRS WRITE-IN COMMENTS

"I think it is great and should save much time for pilots and weather briefers alike."

"A much needed asset to the DCA area due to the heavy congestion on the phone to the FSS."

"I believe this to be a very useful tool to the pilot, and an invaluable service when he is looking at many locations and an alternate for each."

"I didn't realize how much information I was missing in my usual preflight briefings until compared VRS to PATWAS and with a rushed FSS Briefer."

STILL NEED FSS AFTER VRS BRIEFING. "While VRS provides specific data for the airports ect., FSS is better for broad overview of general meteorological conditions."

"The only component missing is that describing frontal movements. VRS allows an instantaneous picture of a specific location, but one must call FSS to receive a general overview of frontal dynamics. I dial VRS for station/enroute weather and then call FSS for a general overview and to file."

"It was generally helpful in deciding when to go to the airport, but further details from FSS were nearly always necessary."

"VRS is excellent for an overview of weather conditions, but feel that a comprehensive brief by FSS is desirable with flight of longer durations."

ADD MORE WEATHER, PIREPS, NOTAMS, SIGMETS, AIRMETS, WINDS ALOFT. "Believe institution of system with "weather synopsis, radar reports, NOTAM/SIGMET, AIRMET, area forecast" capability would relieve FSS facilities of being overworked, especially those on the Eastern Seaboard Megalopolis area."

"On flight from Washington D.C. to Akron, four of five station surface observations do not provide frontal or airmass situation, cloud layers, tops, turbulence, severe weather warnings, NOTAMS."

"The service was good as a basic overview. However, on long-distance flights, I had to contact FSS to obtain frontal information, AIRMETS, SIGMETS, and PIREPS."

"I would like to be able to request important NOTAMS (i.e., runway closed) and any thunderstsrom activity along or near my route of flight."

ADD SYNOPSIS OF WEATHER. "It might be helpful to provide for a synopsis of weather, location, and movement of fronts, etc; on an area-wide basis. This could further reduce the reliance on other sources of information."

"No general synopsis concerning enroute airmass or frontal systems. This should be added with pilot giving general routing info for general synoptic brief, in addition to station sequence reports."

"A general weather synopsis for a given flight area, especially for forecasted weather, would be useful."

"The thing needed to make the system more complete would be a general description of major weather factors such as fronts, movements of fronts, and general outlook for forecast area."

SUGGESTED MECHANICAL AND/OR FORMAT CHANGES. "I'd recommend a longer pause from the last keyed input to the first VRS response. Those of us using telephones which have the pushbuttons on the earpiece carrier (e.g., Bell Trimline) often miss the beginning of a VRS transmission."

"Suggest that a 6-hour forecast be issued along with the initial current hourly weather obs. Most pilots will be interested in the forecast along with current weather."

"The format is somewhat awkward, and the system a little slow. It would be better if you could get the specific info wanted directly instead of going through the whole format, regardless of the "jump ahead" feature."

"How about specifying a certain time for forecast weather. Takes to much listening to obtain info for 12 to 15 hours in advance."

DIFFICULT TO USE/OPERATE. "I've reread the instructions a number of times and repeatedly tried the system. I'm still unable to get all the info I want out of VRS. I've had trouble with numbers, i.e., altitudes, hours."

"Could not make the system work at first, instructions too lengthy. Tried the example and got nothing. I finally got it to work."

"If an error is made interrogating the system, it is time consumming to make the correction."

"Keypad/touchtone alphanumeric system is much too complicated for the user; it requires (1) learning, (2) concentration in use, (3) remembering how to use it."

COMPARISON OF COMMENTS.

The correlation between the type and frequency of comments received on item 12, from the initial as compared to the first followup, was measured using Spearman's rank correlation coefficient as defined by

$$r_s = 1 - \frac{6 \sum_{i=1}^{n} D_i^2}{n(n^2 - 1)}$$

where r_S denotes the Spearman rank-correlation coefficient,

n = number of paired observations (x_i, y_i)

D_i = rank of (X_i) - rank (y_i) = $R_i - S_i$

The comment category and frequency and the ranks that they received are shown in table 35. The comments on the second followup were not similarly tested,

Reference: "Nonparametric Statistical Inference," by J.D. Gibbons

TABLE 35. RANK COMPARISON

	Initial	First Followup	Rank (Initial)	Rank First Followup
Commending the VRS	116	76	1	1
Have Not Flown Recently No Longer Fly-Moved	39	46	3	2
Still Need FSS after VRS	46	16	2	5
Add More Weather	36	18	4	3
Add Synopsis	34	18	5	3
Suggested Mechanical or Format Changes	22	15	6	6
No Touchtone Phone Available	11	16	11	5
Difficult to Use	14	17	9	4
Want More Hours	16	12	7	7
VRS Did Not Work Properly Not Satisfied	15	8	8	9
Use Other Sources for Wx Information	7	9	14	8
Add Route Forecast	13	9	10	8
Prefer Plain Language to Phonetics	9	4	12	10
Speech Rate and Quality	8	3	13	11
Want Toll Free Number	9	1	12	13
Prefer Local Time Instead of GMT	8	1	13	13
Have VRS Record Aircraft ID or Pilot Name	4	2	14	12
Good for Go/No Go Decision	2	2	15	12

since they were not as numerous as the comments received on the initial and first followup. This disparity prevented a basis of comparison.

The Spearman rank-correlation coefficient assumes values from -1 to +1. A value of r_s equal to 1 denotes perfect correspondence between the ranks of the two variables. A value of r_s equal to -1 denotes that the ranks of one variable are in exactly the opposite order as the ranks of the other variable. A value of r_s near zero indicates that the two variables are independent.

For a sample size of 18 and $\alpha = .05$, the critical region consists of all values of $r_s \geq .399$. The value of r_s is 0.86. Since $0.86 > .399$, the value of r_s is in the critical region: therefore, we reject Ho and accept H_1--that the two sets of ranks are positively correlated.

RANDOM SAMPLE OF NONRESPONDENTS.

A telephone followup was conducted on a random sample of nonrespondents to determine whether or not they held strong opinions about the VRS. The answer is that they do not and that there need be no concern about latent adverse opinion. Six hundred telephone calls were made to individuals who did not respond to the questionnaire. Each individual called was selected by using computer-generated random numbers. Of the 600 nonrespondents called, 212 were actually contacted. Figure 41 provides assurance that no pockets of vociferous but previously unexpressed hostility to the VRS exist among the nonrespondents. Ninety-six of the 212 nonrespondents contacted or 45 percent indicated that the reason they did not respond to the questionnaire was that they either have not flown recently, they no longer fly, or they have moved.

It is extremely important to obtain information from the nonrespondents to mailed questionnaires. Voluntary response to mailed questionnaires is likely to contain an intrinsic bias due to the likelihood that people who are interested enough to answer a questionnaire form a special subset as compared to those who are more apathetic. As one writer put it (reference 5):

"Voluntary response to mailed questionnaires is perhaps the most common method of social-science data collection encountered by statisticians, and perhaps also the worst.... More generally, one should realize that voluntary response is such a pervasive problem that it may be expected to introduce bias into any survey using it. Whether the subject is political preference or university parking policies, the intensely interested subset is certain to differ from the more apathetic elements of the population."

SUMMARY OF MULTIVARIATE ANALYSIS, SUBGROUP RESPONSES.

The preceding subsections indicate that, as a group, the responses to question 6 of the questionnaire were quite favorable to the VRS. It is also desirable to know whether or not large subgroups of respondents are similarly favorably disposed. Important response differentials would point the way to further improvements that might be required in the VRS to increase its acceptability to identifiable segments of the user population.

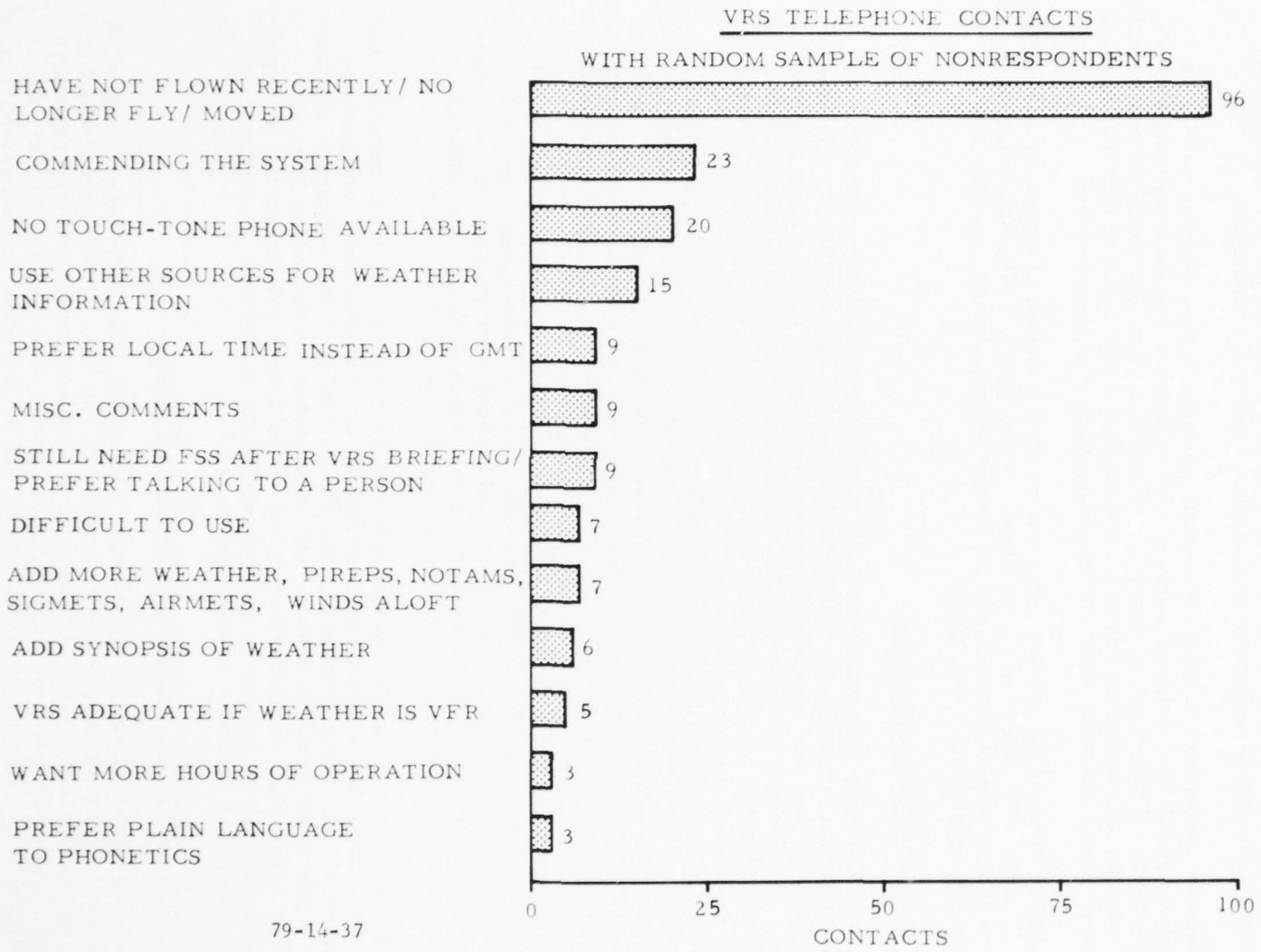


FIGURE 41. FREQUENCY DISTRIBUTION OF VRS RESPONSES TO TELEPHONE FOLLOWUP

A main effects analysis of variance model was used in the multivariate analysis of question 6. The program was run on an International Business Machine (IBM) 369/9020 computer using the program distributed by International Education Services. The mathematical foundations are presented by Finn (reference 5). The input data consisted of the returns from the initial, first followup, and second followup mailing.

The four main effects were the following classification variables listed at the beginning of the questionnaire:

1. Weather Rating

2. Total Flying Time

3. Flying Time in 12 Months Prior to Completing Questionnaire

4. Number of Times VRS Used

Two levels of each effect were used in the analysis. The threshold values separating the levels are shown in table 36.

Question 6 of the VRS questionnaire was scored in terms of a Likert-type scale. Guilford (reference 6 p. 459) discusses the justification for and utility of handling five-point response scales in this form. Weights of 1 through 5 are assigned the categories in the five-point scale. Although there may become debate on the point, it is commonly considered that this method yields an interval scale to which statistical operations appropriate to such a scale can be applied (see, for example, Stevens, reference 7, p. 25).

The results of the analysis of question 6 are presented below. The scale values shown in tables 37, 38, 39, and 40 and figures 42 though 45 were derived by assigning numerical values to each of the five response categories for each item in question 6 and computing averages weighted by the number of respondents in each category. The value "3" was assigned to the middle category (uncertain) with descending and ascending unit values employed for adjacent categories depending on whether the question is negative or positive toward VRS. Thus, values greater then "3" signify a favorable reaction to the VRS. It should be noted that all of the stimulus items are significantly larger than the indifference value of "3."

Tables 41, 42, 43, and 44 show the univariate F ratio and the probability value for each stimulus item. Table 41 indicates a statistically significant difference ($\rho \leq .05$) between the VFR and IFR pilot with respect to item 6c "Speech too fast." The IFR pilot responded more favorably to item 6c; that is to say, he responded more frequently with Disagree or Strongly Disagree than did the

TABLE 36. VALUES ASSIGNED TO THE CLASSIFICATION PARAMETERS USED IN THE MULTIVARIATE ANALYSIS

Classification Parameter	Analysis Level Number 1	2
1. License/Rating	VFR (Student, Private VFR, Commercial VFR)	IFR (Private IFR, Commercial IFR, Air Transport)
2. Total Flying Hours	0 - 400	> 400
3. Annual Flying Hours	0 - 50	> 50
4. No. Times VRS Used	0 - 10	> 10

TABLE 37. SCALE VALUE COMPARISONS FOR QUESTION 6, VFR VERSUS IFR

	VFR Scale Values	IFR
a. Order of Information	4.11	4.20
b. Information Sufficient for Decision to Airport	4.08	4.02
c. Speech Rate	3.93	4.13
d. Clear Mental Picture of Weather	3.67	3.72
e. Amount of Information Provided	3.43	3.41
f. VRS Operating Procedures	3.91	4.04
g. Intelligibility	3.91	3.82
h. Speech Rhythm and Intonation	3.85	4.00
i. Pleasantness of VRS Speech	4.27	4.35
j. Briefing Satisfaction	4.05	4.01

Note: Values greater than 3 signify a favorable reaction.

TABLE 38. SCALE VALUE COMPARISONS FOR QUESTION 6, 400 HOURS OR UNDER VERSUS OVER 400 HOURS TOTAL FLYING TIME

		≤ 400	> 400
		Scale Values	
a.	Order of Information	4.15	4.17
b.	Information Sufficient for Decision to Airport	4.02	4.07
c.	Speech Rate	3.93	4.12
d.	Clear Mental Picture of Weather	3.67	3.71
e.	Amount of Information Provided	3.41	3.42
f.	VRS Operating Procedures	3.99	3.99
g.	Intelligibility	3.85	3.86
h.	Speech Rhythm and Intonation	3.82	4.00
i.	Pleasantness of VRS Speech	4.29	4.33
j.	Briefing Satisfaction	4.04	4.02

Note: Values greater than 3 signify a favorable reaction.

TABLE 39. SCALE VALUE COMPARISONS FOR QUESTION 6, 50 HOURS OR UNDER VERSUS OVER 50 HOURS ANNUAL FLYING TIME

	≤ 50	> 50
	Scale Values	
a. Order of Information	4.13	4.19
b. Information Sufficient for Decision to Airport	4.01	4.08
c. Speech Rate	3.90	4.15
d. Clear Mental Picture of Weather	3.69	3.70
e. Amount of Information Provided	3.50	3.35
f. VRS Operating Procedures	3.97	3.99
g. Intelligibility	3.91	3.81
h. Speech Rhythm and Intonation	3.91	3.94
i. Pleasantness of VRS Speech	4.31	4.31
j. Briefing Satisfaction	4.06	4.01

Note: Values greater than 3 signify a favorable reaction.

TABLE 40. SCALE VALUE COMPARISONS FOR QUESTION 6, VRS USED 10 TIMES OR UNDER VERSUS VRS USED OVER 10 TIMES

	≤ 10	> 10
	Scale Values	
a. Order of Information	4.11	4.27
b. Information Sufficient for Decision to Airport	4.01	4.12
c. Speech Rate	3.93	4.25
d. Clear Mental Picture of Weather	3.67	3.74
e. Amount of Information Provided	3.46	3.35
f. VRS Operating Procedures	3.85	4.23
g. Intelligibility	3.93	3.73
h. Speech Rhythm and Intonation	3.91	3.98
i. Pleasantness of VRS Speech	4.27	4.39
j. Briefing Satisfaction	3.97	4.15

Note: Values greater than 3 signify a favorable reaction.

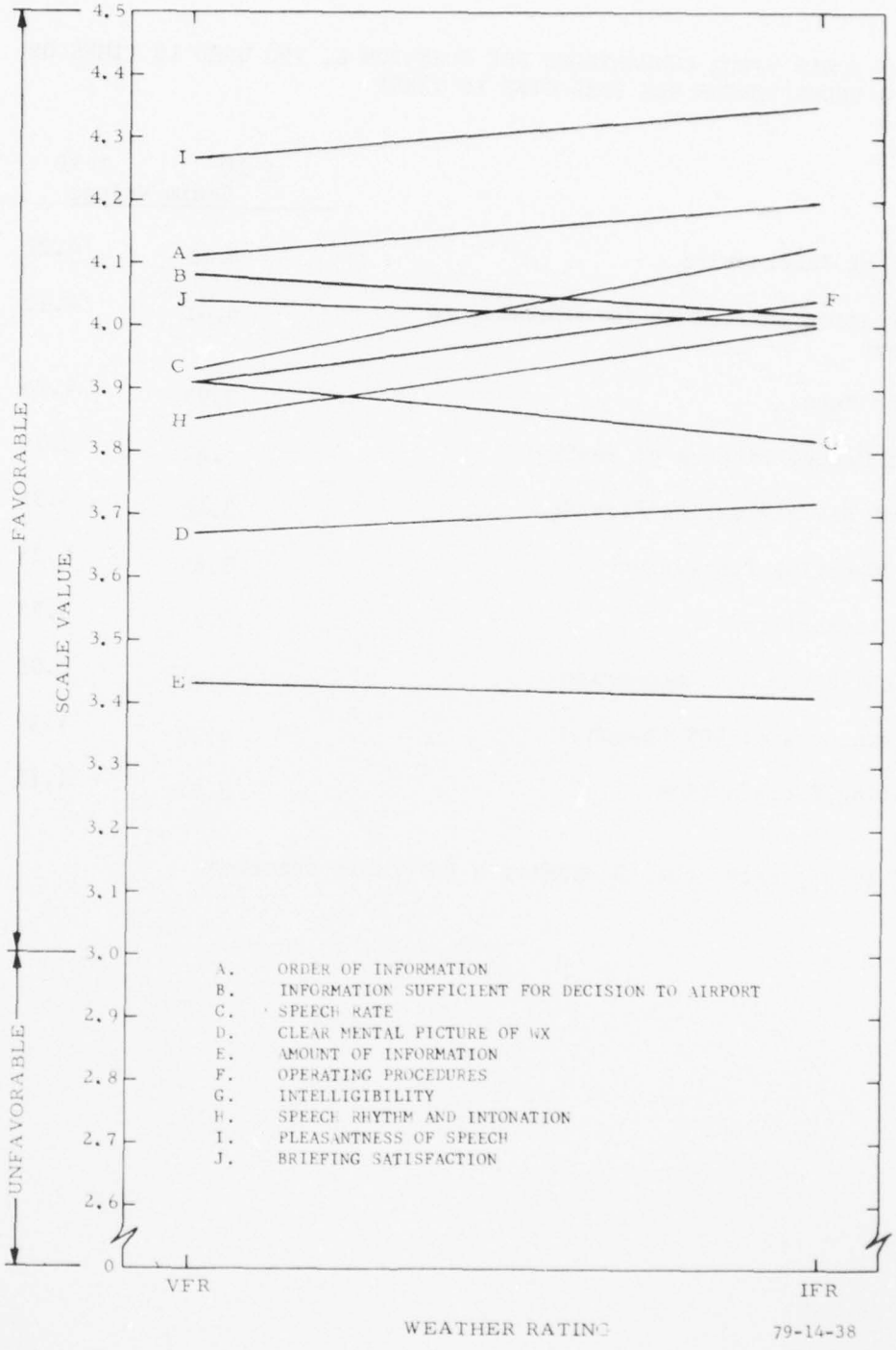


FIGURE 42. SCALE VALUE COMPARISONS FOR QUESTION 6, VFR VERSUS IFR

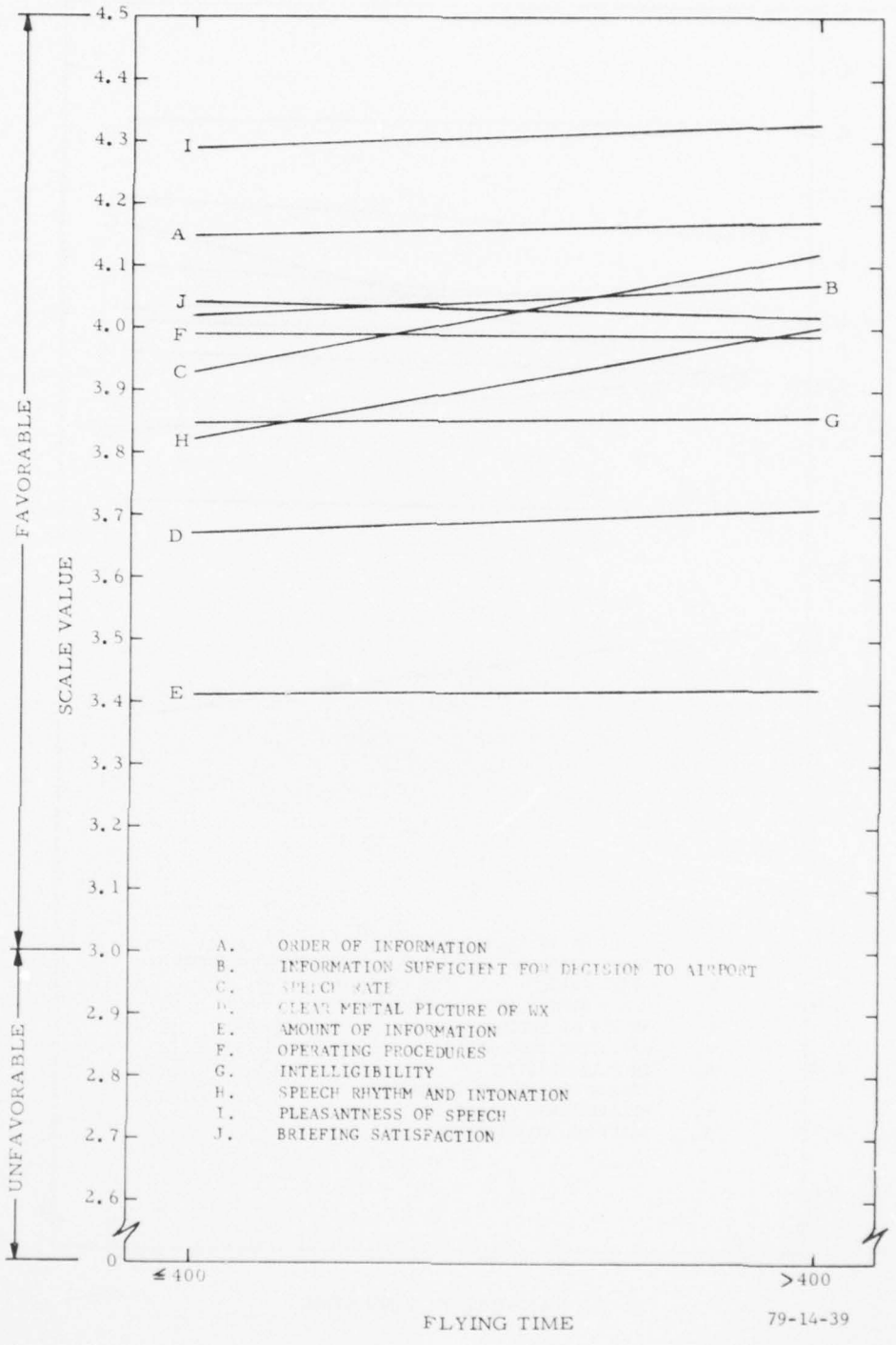


FIGURE 43. SCALE VALUE COMPARISONS FOR QUESTION 6, OVER VERSUS UNDER 400 HOURS PILOT TOTAL FLYING TIME

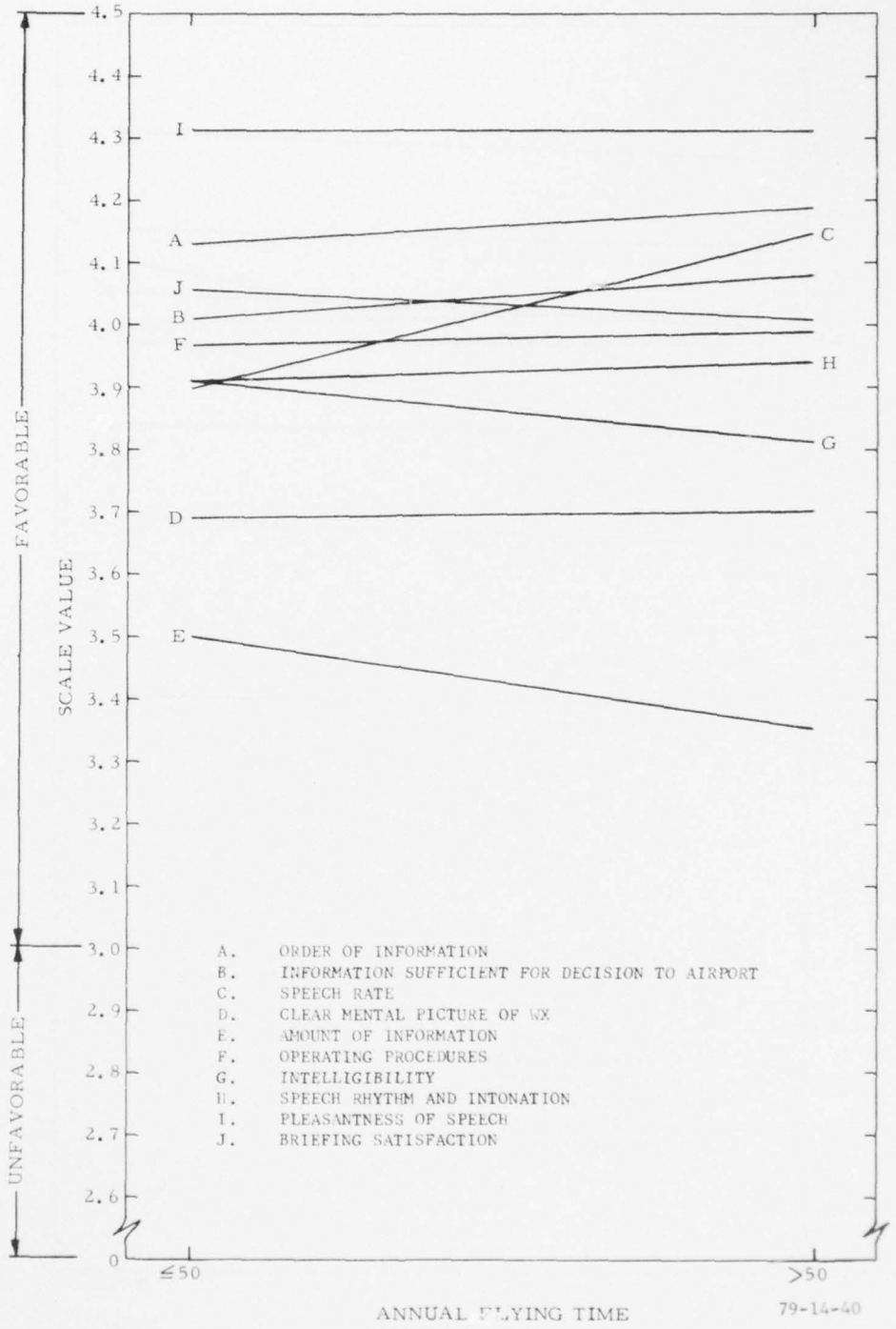


FIGURE 44. SCALE VALUE COMPARISONS FOR QUESTION 6, OVER VERSUS UNDER 50 ANNUAL HOURS FLYING TIME

AD-A072 752 NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATL--ETC F/G 4/2
VOICE RESPONSE SYSTEM (VRS) SURVEY.(U)
JUL 79 E SHOCHET, H MILLIGAN, R J REGAN

UNCLASSIFIED FAA-NA-79-14 FAA-RD-79-47 NL

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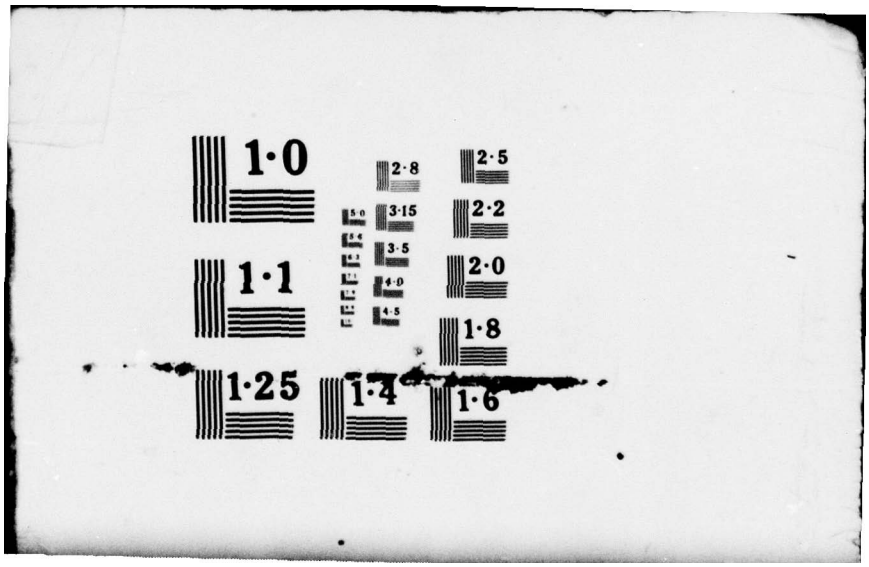
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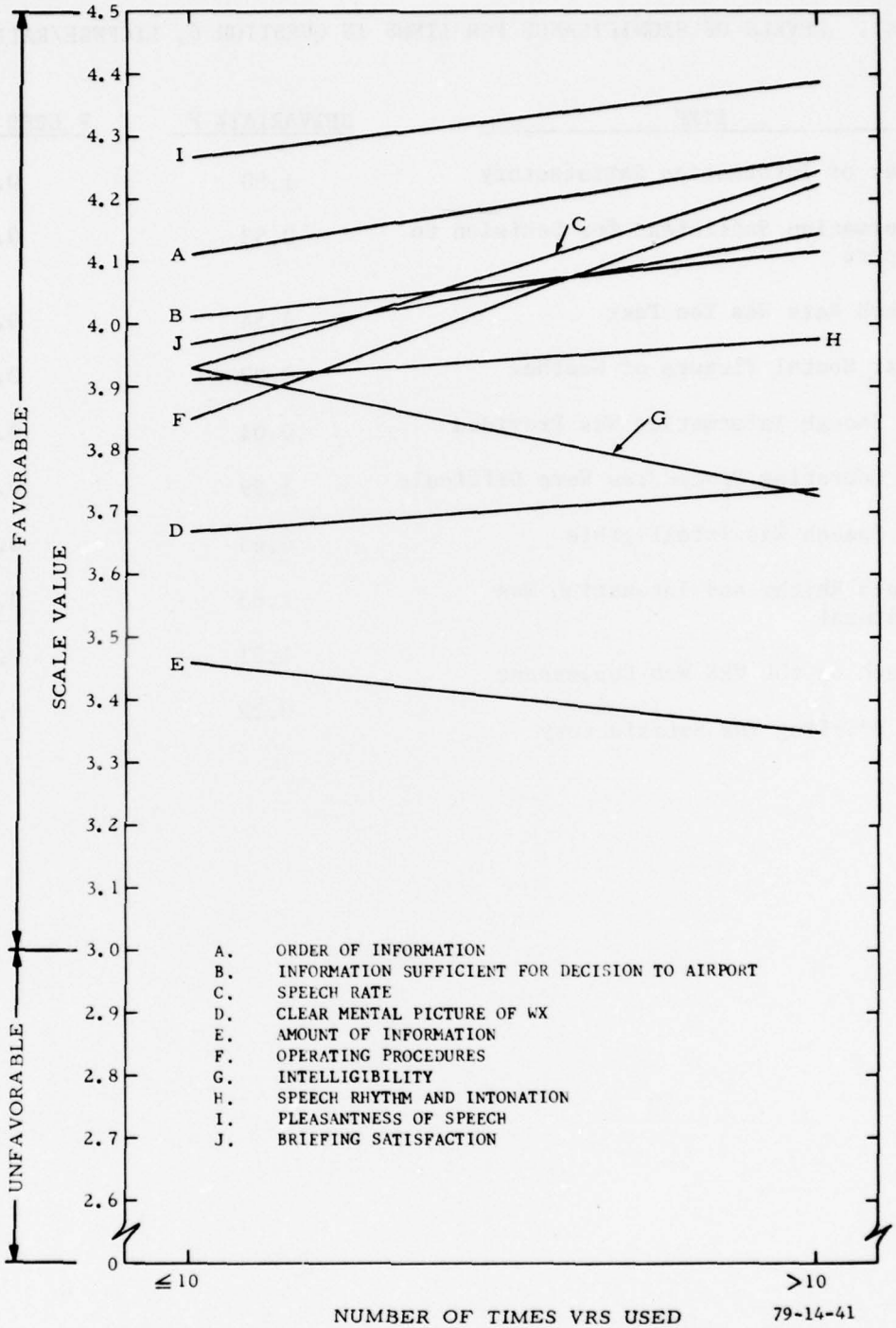

FIGURE 45. SCALE VALUE COMPARISONS FOR QUESTION 6, USED VRS OVER VERSUS UNDER 10 TIMES

TABLE 41. LEVELS OF SIGNIFICANCE FOR ITEMS IN QUESTION 6, LICENSE/RATING

ITEM	UNIVARIATE F	P LESS THAN
a. Order of Information Satisfactory	1.80	0.18
b. Information Sufficient for Decision to Airport	0.53	0.47
c. Speech Rate Was Too Fast	4.54	0.03
d. Clear Mental Picture of Weather	0.27	0.61
e. Not Enough Information Was Provided	0.01	0.91
f. VRS Operating Procedures Were Difficult	1.59	0.21
g. The Speech Was Intelligible	0.45	0.50
h. Speech Rhythm and Intonation Was Unnatural	2.63	0.11
i. Speech on the VRS Was Unpleasant	1.31	0.25
j. The Briefing Was Satisfactory	0.22	0.64

TABLE 42. LEVELS OF SIGNIFICANCE FOR ITEMS IN QUESTION 6, TOTAL FLYING TIME

ITEM	UNIVARIATE F	P LESS THAN
a. Order of Information Satisfactory	0.59	0.44
b. Information Sufficient for Decision to Airport	2.42	0.12
c. Speech Rate Was Too Fast	0.47	0.49
d. Clear Mental Picture of Weather	0.04	0.84
e. Not Enough Information Was Provided	0.07	0.79
f. VRS Operating Procedures Were Difficult	0.95	0.33
g. The Speech Was Intelligible	0.69	0.41
h. Speech Rhythm and Intonation Was Unnatural	1.44	0.23
i. Speech on the VRS Was Unpleasant	0.16	0.69
j. The Briefing Was Satisfactory	0.00	0.95

TABLE 43. LEVELS OF SIGNIFICANCE FOR ITEMS IN QUESTION 6, ANNUAL FLYING TIME

ITEM	UNVARIATE F	P LESS THAN
a. Order of Information Satisfactory	0.21	0.64
b. Information Sufficient for Decision to Airport	1.13	0.29
c. Speech Rate Was Too Fast	3.84	0.05
d. Clear Mental Picture of Weather	0.00	1.00
e. Not Enough Information Was Provided	2.34	0.13
f. VRS Operating Procedures Were Difficult	0.01	0.94
g. The Speech Was Intelligible	0.47	0.49
h. Speech Rhythm and Intonation Was Unnatural	0.16	0.69
i. Speech on the VRS Was Unpleasant	0.14	0.71
j. The Briefing Was Satisfactory	0.24	0.62

TABLE 44. LEVELS OF SIGNIFICANCE FOR ITEMS IN QUESTION 6, VRS USAGE

	UNIVARIATE F	P LESS THAN
a. The Order in Which the Information Was Presented Was Satisfactory.	4.19	0.04
b. The Infromation Was Sufficient to Make a Decision to Go to the Airport.	1.72	0.19
c. The Speech Rate Was Too Fast.	8.71	0.00
d. The Information Provides a Clear Mental Picture of the Weather.	0.54	0.46
e. Not Enough Information Was Provided	0.58	0.45
f. The VRS Operating Procedures Were Difficult.	12.23	0.00
g. The Speech Was Intelligible.	1.67	0.20
h. The Speech Rhythm and Intonation Was Unnatural.	0.80	0.37
i. The Speech on the VRS Was Unpleasant.	3.07	0.08
j. The Briefing Was Satisfactory.	5.66	0.02

VFR pilot (see figure 42). No statistically significant difference was found between pilots with less than or equal to 400 hours of flying time and pilots with more than 400 hours. Table 43 indicates a statistically significant difference ($\rho \leq .05$) between pilots with less than or equal to 50 hours flown during the past 12 months and those that flew more than 50 hours with respect to item 6c, "Speech too fast." The pilot with more than 50 hours of flight time during the past 12 months responded more favorably to item 6c (by disagreeing or strongly disagreeing with the statement), thus producing a higher scale value (see figure 44). Numerous statistically significant differences were found between respondents who used the VRS less than or equal to 10 times and respondents who used the system more than 10 times with respect to the following items:

6(a) Order of Information Satisfactory

6(c) Speech Too Fast

6(f) Operating Procedures Difficult

6(j) Briefing Satisfactory

In all of the above cases, pilots who used the system more than 10 times responded more favorably to the VRS than pilots who used the system 10 times or less. That is to say, the more frequent users of the VRS (> 10) rated the system significantly higher in the above listed areas than the less frequent users ($\leq$ 10) (see figure 45). This was especially true for item 6g, "The VRS operating procedures were difficult." For this item, p was less than 0.0006. As might be expected, the more frequent user found the VRS operating procedures less difficult.

VRS TELEPHONE ACTIVITY

The following explanation and description of the procedures used to collect VRS telephone activity data was provided by the Transportation System Center (TSC).

VRS STATISTICAL REPORT.

During each VRS operating day, raw statistical data are stored in a file. This file is the basis of the statistical report. The first block of the file contains both the starting time and the finish time. These values of data and minute of day are presented on the first page of the report.

The remainder of the raw statistical data file consists of records, with one record per event. The event records are subdivided by channel. Within each channel the records are in chronological order. The records of each channel are divided into users. A new user starts with a channel ringing event and terminates with a channel hangup event.

Each line in the report represents data for single user. However, no user is included unless he did more than dial the phone. A daily summary is included at the end of the report.

There are three report forms; the header, the user report, and the daily summary. Each will be described below.

THE HEADER. The header has the start and finsh time for the raw data file, with the following information:

1)	Start Date	year, month, date
	Block	first data block
	Byte	first data byte
	Time	minutes since midnight Greenwich Mean Time (G.m.t.)
2)	Finish Date	year, month, day
	Block	last data block
	Byte	last data byte
	Time	minutes since midnight G.m.t.

USER REPORT. The User Report has one line per user. There are 17 columns, divided into 4 groups. The first group has one column, G.m.t. time. This is the time of the user channel hang up.

Group two has four columns, each of which is a count of user requests. Column Loc is a count of location indentifiers entered. Column SA is a count of SA reports requested. Column FT is a count of FT reports requested. Column FD is a count of FD reports requested.

Group three has six columns and shows the allocation of user time. Column Time shows the total time allocated to the user. Column Over shows the time allocated to overhead. Column Loc shows the time allocated to entering location identifiers. This is from entrance of the first letter until the message is sent to the PDP 11-70 and accepted by the PDP 11-70. Column SA is time from the SA request until all SA's have been spoken. Column FT is the time from a request for FT reports until all FT reports are spoken. Column FD is the time from the FD request until all the FD reports are spoken.

Group four has six columns, which contain the counts of how many times the user used the special functions.

Special Functions

Title	Function
Stop	Stop
Go	Go
RPT	Repeat
DEL	Cancel last location identifier
JMP	Skip remainder of report
BEG	Recycle to beginning protocol

SUMMARY REPORT. The fourth report type is a summary of the day's activity. The first column is the hour G.m.t. The second column is the number of users during the hour. The third column is the average time used by each user. The fourth column is the maximum number of simultaneous users during the hour.

Below this is the total number of user. This is after deleting users who rang up and then hung up the channel.

The average time is the total time by all users, divided by the number of users. Next is the maximum number of simultaneous users for the entire day.

The fractional percent is found by summing the times for all users and dividing the time for each purpose by the total time users were on the system.

ANALYSIS OF THE VRS STATISTICAL FILE.

During each VRS operating day, a trace file is maintained. In block zero of the file is the starting date and time in seconds and finishing date and time in seconds. The first page of the statistical report contains these data as date and time in minutes for identification.

The remainder of the file contains event records and these are used for analysis. The event records are subdivided into groups based on channel number. The events records are in chronological order. User's records are defined as all those records for a channel which are between a channel ringing record and the first channel hungup record inclusive. Specifically, the channel ringing is when the lower byte of US.FLC equals five and the channel hungup is when the lower byte of US.FLC equals six. The statistics for each user is put on one line of the report. However, any user whose second event is channel hungup is not recorded in the statistics.

Using the user data, the gross statistics are computed. The time of day in column one is the G.m.t. time on the event record channel hungup. The

briefing time in column six is the difference in time between the time of day on the channel ringing event and the channel hungup event.

In order to get the counts in columns two through five, each user records are divided into passes. A pass consists of two phases, (1) a location identifier entering phase and (2) a report requesting phase.

The location identifier count in column two is done in two parts. First, the location entering phase is checked to locate the record which has the greatest location identifer count. This is the location count for the pass. Then the location count for the pass is summed up for the user to get the location count for the user in column two. The location identifier input phase is defined by the high order byte of US.KEY being either equal to one (Loc ID) or five (Nxt Loc).

The report count is computed for each pass by checking the high order byte of US.KEY. If a report is requested during that pass (13 for SA's, 15 for FT's, 19 for FD's), the number of reports of that type requested for that pass equals the number of location identifiers entered that pass. This is then summed over the passes for that user and entered in columns three, four, and five. Use of the repeat special key may lead to getting multiple report counts in one pass.

The allocation of time to overhead, location, SA, FT, and FD are allocated by use of the high order byte of US.KEY. When two consecutive records for one user have different keyword values, the time between them is allocated to the second record keyword value. For this purpose: (1) keyword values one (Loc ID) and five (Nct Loc) are considered equal; (2) keyword values 16 (wind), 17 (time), and 18 (altitude) are FD reports, and (3) keyword values 2 (brief) and 4 (brief 2) are assigned to the report request preceding them.

An example of assigning keyword values brief and brief 2. If there are three consecutive records for one user and the first keyword value is 13 (SA), the second record two (brief), and third record four (brief 2), the routine assumes all keyword values are 13 (SA).

Columns 11 through 15 contain counts of the special functions. As each record is processed, the low order byte of US.STA is checked. If the byte has a value greater than 40 octal, it is processed by incrementing the counter for that special function.

SPECIAL FUNCTION CODES

FUNCTION	OCTAL VALUE
Stop	42
Go	43
Begin	44
Repeat	45
Jump	46
Delete	51

SUMMARY OF VRS TELEPHONE ACTIVITY.

Table 45 shows the summary of the VRS telephone activity for the period June 1, 1978, through September 30, 1978. (Data collection for this report ended on September 30, 1978).

AOPA SURVEY

The Aircraft Owners and Pilots Association (AOPA), at their own expense, printed and mailed approximately 11,000 questionnaires to pilots, requesting their participation in evaluating the Voice Response System.

The data received from that survey, gave approximately the same results as those contained in this report.

TABLE 45. SUMMARY OF VRS TELEPHONE ACTIVITY FROM JUNE 1, 1978, THROUGH SEPTEMBER 30, 1978

HR	Avg # Users	Grand Avg Time	Avg Simul User
0	30.000	3.000	3.000
1	19.666	2.866	4.000
2	10.500	2.900	3.000
3	8.000	4.000	2.000
4	1.000	2.200	1.000
5	1.500	4.100	1.000
6	12.000	3.600	2.000
7	6.000	4.500	2.000
8	18.000	3.500	5.000
9	2.263	2.442	1.368
10	11.533	4.240	3.631
11	21.314	4.024	4.704
12	28.787	3.847	5.481
13	30.142	3.922	5.767
14	29.490	3.832	5.481
15	28.803	3.760	5.607
16	27.146	3.741	5.449
17	29.740	3.786	5.666
18	31.629	3.844	5.796
19	33.296	3.803	6.289
20	31.101	3.660	5.703
21	23.174	3.753	4.731
22	20.266	4.104	4.557
23	13.734	4.101	3.963

	Total	Avg
Total Users	38772	
Avg Time		3.869
Max. Simul Users		7.940
OV HR		20.947
LOC ID		12.728
SA		26.203
FT		30.076
FD		10.016

Days Missing
July 13
Sept. 1
Sept. 16
Sept. 17

CONCLUSIONS

From the results, it is concluded that:

1. *The VRS is a practical and effective means by which pilots can, in many instances, obtain a satisfactory overview of weather conditions.* For preflight planning, 56 percent of the pilots indicated that it was unnecessary to call the Flight Service Station (FSS) for weather information after receiving the VRS briefing. Of those who still found it necessary to call the FSS for weather information after receiving the VRS briefing, 90 percent indicated that the VRS briefing reduced the time on line with the FSS. The average reduction in time on line with FSS for preflight planning was estimated to be 47 percent.

2. *The VRS operating procedures are simple enough for most pilots to master with minimal practice.*

3. *The public reaction to the VRS was highly favorable. Analysis of the data obtained from the questionnaires indicates a high level of acceptance of the VRS.* Ninety-three percent of the respondents indicated that the VRS is either "suitable with minor changes" or "suitable as is."

4. *No significant difference in the results existed between license types or experience levels of general aviation pilots.*

5. *The quality of speech (i.e., pleasantness, rate rhythm, intonation, and intelligibility) are acceptable for public dissemination.*

6. *Additional weather products and the provision of NOTAM's would provide for a better overview of weather and flying conditions.*

RECOMMENDATIONS

1. The following seven additional products should be incorporated into the Voice Response System as they become available.

    1. PIREP's--Pilot reports on weather
    2. NOTAM's--Notices to airmen
    3. SIGMET's--Significant weather information
    4. AIRMET's--Airmens Meteorological Information
    5. Weather Synopsis
    6. Route Forecast
    7. Area Forecast

2. The spoken name readback method should be used for location indentifiers.

3. The impact of the Voice Response System on FSS specialist workload was not and cannot be determined in the Washington metropolitan area due to many

improvements such as MAPS, improved PATWAS, TEL-TWEB, 800 lines, and consolidation. In the event a second VRS installation is implemented, it is recommended that a further study be conducted to determine the effects of the VRS on specialists' workload and that this study be performed in a controlled field environment.

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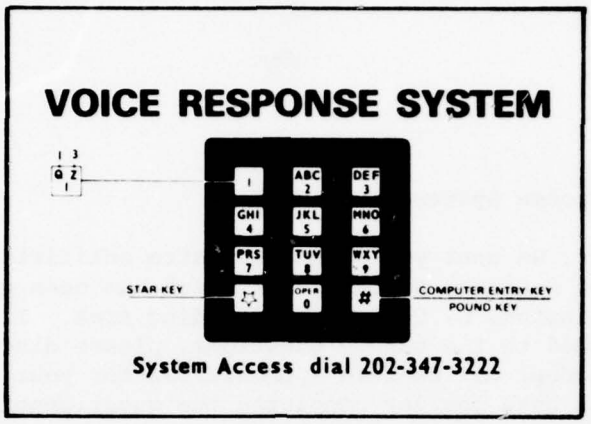
APPENDIX A

PERTINENT VRS SURVEY LITERATURE

LIST OF ILLUSTRATIONS



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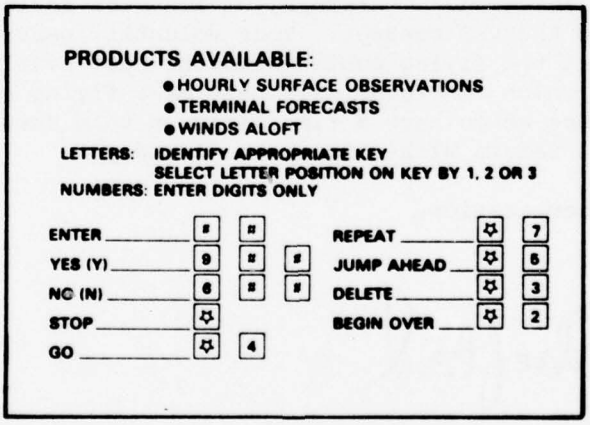


BACK

FIGURE A-1. VRS WALLET-SIZE CARD

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

Form Approved
OMB No. 04-S78010
Use Expires September 1978

August 1978

TO: All Pilots

SUBJECT: Voice Response System (VRS) Survey

In July of this year, we sent you a questionnaire soliciting your opinion of the Voice Response System (VRS) which has been demonstrated in the Washington, D. C., and surrounding area. If you have already responded to the survey questions, please disregard this reminder and accept our sincere appreciation for your cooperation. If you have not yet completed the questionnaire, or if you were not able to access the VRS prior to the time you received the first questionnaire and have now had an opportunity to do so, we earnestly request that you complete the questionnaire as soon as possible.

The success of this survey depends, to a large extent, on the number of responses obtained. Therefore, we are most anxious to get your reaction to the VRS concept. Your voluntary participation will help ensure that the flying public gets the best available weather information which, in turn, will help make flying safer and more enjoyable. Since we do have a time limit on this survey, we would appreciate its return within fourteen (14) days.

Thank you for your cooperation.

Sincerely,

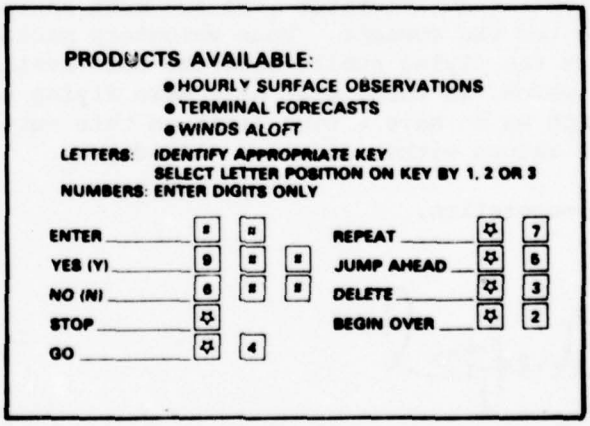
David J. Sheftel

DAVID J. SHEFTEL
Director, Systems Research
and Development Service

Enclosure

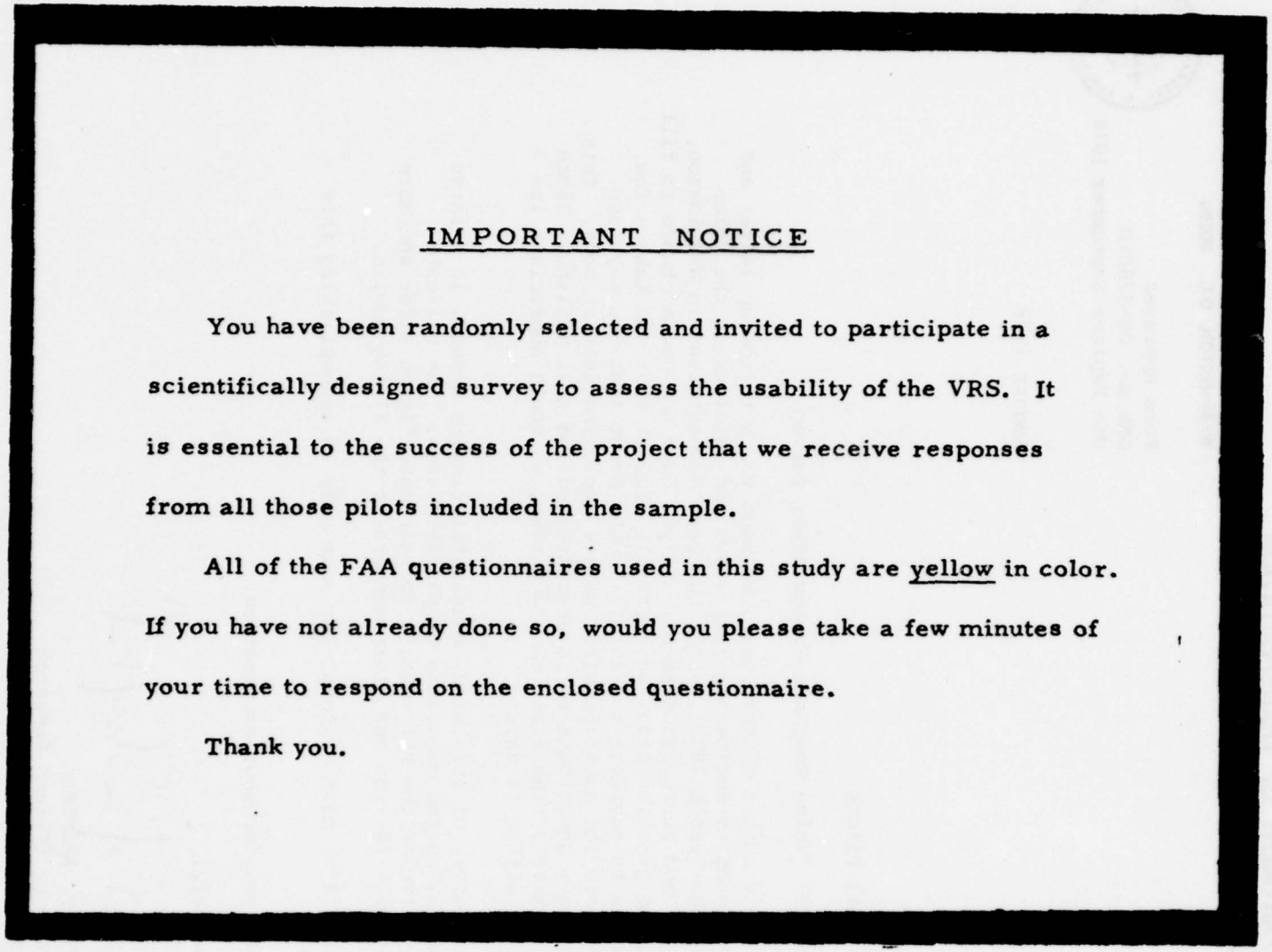
FIGURE A-2. FIRST FOLLOWUP COVER LETTER

FRONT



BACK

FIGURE A-1. VRS WALLET-SIZE CARD



IMPORTANT NOTICE

You have been randomly selected and invited to participate in a scientifically designed survey to assess the usability of the VRS. It is essential to the success of the project that we receive responses from all those pilots included in the sample.

All of the FAA questionnaires used in this study are yellow in color. If you have not already done so, would you please take a few minutes of your time to respond on the enclosed questionnaire.

Thank you.

FIGURE A-3. NOTICE ACCOMPANYING FIRST FOLLOWUP COVER LETTER

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

Form Approved
OMB No. 04-S78010
Use Expires September 1978

August 1978

TO: All Pilots

SUBJECT: Voice Response System (VRS) Survey

In early August of this year, we sent you a follow-up letter and questionnaire soliciting your views and opinions on the Voice Response System (VRS), which has been demonstrated in Washington, D. C., and surrounding areas. If you have not had a chance to fill out the questionnaire, we earnestly request that you take a few minutes to complete the form. In the event that you may have misplaced the questionnaire, we are enclosing another copy. This voluntary questionnaire is preaddressed and self mailing. Since we do have a time limit on the survey, we would appreciate its return within 14 days.

In a survey of this kind, meaningful results depend, in a large measure, on the magnitude of participation. The ultimate objective of the VRS test is to help make flying safer and more enjoyable for you and other members of the flying public.

We would be most grateful for your help in accomplishing this task.

Thank you for your cooperation.

Sincerely,

David J. Sheftel

DAVID J. SHEFTEL
Director, Systems Research
and Development Service

Enclosure

FIGURE A-4. SECOND FOLLOWUP COVER LETTER

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

August 1978

TO: All Computer Generated Voice Users

SUBJECT: Pilot Evaluation of the Voice Response System (VRS)

For the past 4 months, the Federal Aviation Administration (FAA) has been conducting a public demonstration of the experimental computer generated VRS. Pilot participation thus far in the demonstration has been excellent and interest in the concept from the general public and technical communities has been abundant. The performance of the system has been improved since the start of the demonstration in April providing increased system availability to pilots.

In July, a questionnaire was mailed by the FAA to a scientifically selected sample of pilots to obtain user reaction and input on the VRS concept. Additional questionnaire forms have also been made available by user organizations in the Washington, D. C., area. We encourage pilot participation in these surveys and particularly solicit the input of those pilots selected in the FAA's sample. To assure all pilots have an opportunity to voluntarily take part in the VRS survey, the FAA will distribute post-paid questionnaire forms to fixed-based operators facilities in the Washington, D. C., area. These forms will be made available through September 30, 1978, at which time all data collection will be terminated.

In response to many inquiries regarding information on location identifiers for system use, several reference charts have been assembled and are enclosed for your convenience. We believe this data will greatly enhance your ability to effectively use the system.

Again, we encourage your participation in the evaluation survey and take this opportunity to thank you for your interest and support during this important phase of VRS development.

Sincerely,

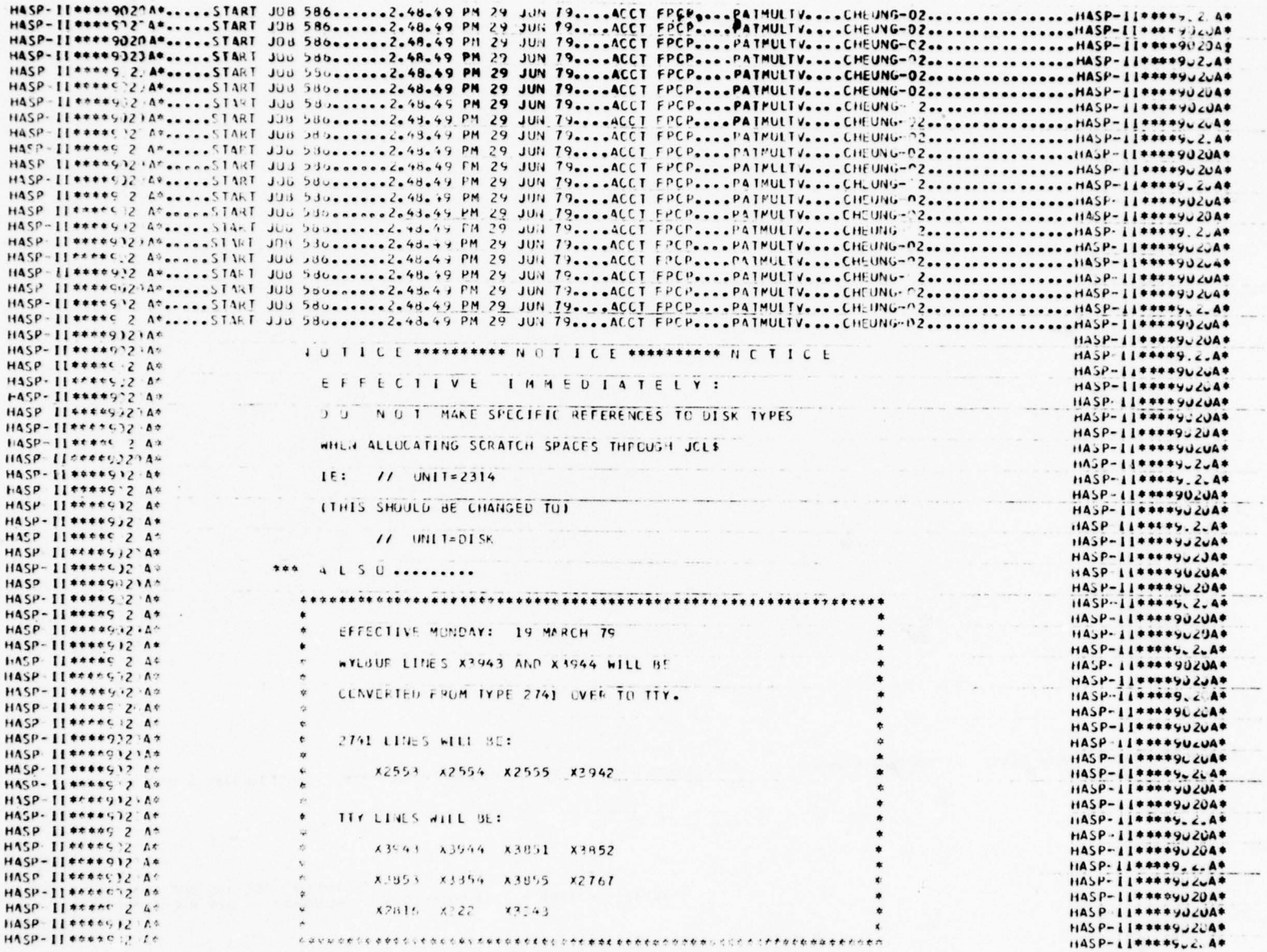
DAVID J. SHEFTEL
Director, Systems Research
and Development Service

Enclosure

FIGURE A-5. LETTER TO PILOTS NOT SELECTED FOR VRS SURVEY

APPENDIX B

MULTIVARIATE ANALYSIS OF VARIANCE


HASP-II****9020A*.....START JOB 586.....2.48.49 PM 29 JUN 79....ACCT FPCP....PATMULTV....CHEUNG-02.....HASP-II****9020A*
NOTICE ********** NOTICE ********** NOTICE
EFFECTIVE IMMEDIATELY:
DO NOT MAKE SPECIFIC REFERENCES TO DISK TYPES
WHEN ALLOCATING SCRATCH SPACES THROUGH JCLS
IE: // UNIT=2314
(THIS SHOULD BE CHANGED TO)
// UNIT=DISK
*** A L S O .....
EFFECTIVE MONDAY: 19 MARCH 79
WYLBUR LINES X3943 AND X3944 WILL BE
CONVERTED FROM TYPE 2741 OVER TO TTY.
2741 LINES WILL BE:
X2553 X2554 X2555 X3942
TTY LINES WILL BE:
X3941 X3944 X3851 X3852
X3853 X3854 X3855 X2767
X2816 X822 X3943

HASP SYSTEM ICG

$ 14.16.57 JOB 586 -- PATAULTV -- BEGINNING EXEC - INIT 3 - CLASS N
$ 14.28.48 JOB 586 END EXECUTION.

HASP-II JOB STATISTICS -- 463 CARDS READ -- 1,655 LINES PRINTED -- 0 CARDS PUNCHED -- 11.86 MINUTES EXECUTION TIME

```
//PATMULTV JOB (156F,FPCB,9 ,6 ),'CHEUNG- 2',CLASS=N,REGION=3  K          JOB 5F6
// EXEC PGM=MULTV,PARM=1 ),TIME=1439
//STEPLIB DD DSN=MULTVPG4,DISP=(OLD,CATLG),UNIT=SYSDA,
// VOL=SER=DK5
//FT01F  1 DD DSN=&&ITAPEB,UNIT=SYSDA,SPACE=(TRK,(1  ,1 )),
// DCB=(RECFM=VBS,LRECL=1688,BLKSIZE=1692)
//FT 2F  1 DD DSN=&&ITAPEC,UNIT=SYSDA,SPACE=(TRK,(1 ,1 )),
// DCB=(RECFM=FB,LRECL=96,BLKSIZE=96)
//FT 3F  1 DD DSN=&&ITAPED,UNIT=SYSDA,SPACE=(TRK,(1  ,1 )),
// DCB=(RECFM=VBS,LRECL=1688,BLKSIZE=1692)
//FT 4F  1 DD DSN=&&ITAPEE,UNIT=SYSDA,SPACE=(TRK,(1  ,1 )
// DCB=(RECFM=VBS,LRECL=1688,BLKSIZE=1692)
//FT05F  1 DD DDNAME=SYSIN
//FT 6F  1 DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=133,BUFNO=1)
//SYSUDUMP DD SYSOUT=A
//FT 7F  1 DD SYSOUT=B,DCB=(RECFM=FB,LRECL=8 ,BLKSIZE=8 ,BUFNO=1)
//FT 8F  1 DD DSN=&&ITAPEA,UNIT=SYSDA,SPACE=(TRK,(1  ,1 )),
// DCB=(RECFM=VBS,LRECL=1688,BLKSIZE=1692)
//SYSIN DD *
//
IEF236I ALLOC. FOR PATMULTV
IEF237I 153   ALLOCATED TO STEPLIB
IEF237I 195   ALLOCATED TO FT01F  1
IEF237I 191   ALLOCATED TO FT 2F  1
IEF237I 195   ALLOCATED TO FT 3F  1
IEF237I 191   ALLOCATED TO FT 4F  1
IEF237I 314   ALLOCATED TO FT05F  1
IEF237I 324   ALLOCATED TO FT 6F  1
IEF237I 325   ALLOCATED TO SYSUDUMP
IEF237I 330   ALLOCATED TO FT 7F  1
IEF237I 191   ALLOCATED TO FT 8F  1
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   MULTVPGM                                    NOT CATLGD  2
IEF287I   VOL SER NOS= DK5  .
IEF285I   SYS7918 .T1417 1.RV   .PATMULTV.ITAPEB      DELETED
IEF285I   VOL SER NOS= ITSCR1.
IEF285I   SYS7918 .T1417 1.RV   .PATMULTV.ITAPEC      DELETED
IEF285I   VOL SER NOS= ITSCR3.
IEF285I   SYS7918 .T1417 1.RV   .PATMULTV.ITAPED      DELETED
IEF285I   VOL SER NOS= ITSCR1.
IEF285I   SYS7918 .T1417 1.RV   .PATMULTV.ITAPEE      DELETED
IEF285I   VOL SER NOS= ITSCR3.
IEF285I   SYS7918 .T1417 1.RV   .PATMULTV.ITAPEA      DELETED
IEF285I   VOL SER NOS= ITSCR4.
IEF373I STEP /         / START 7918 .1417
IEF374I STEP /         / STOP  7918 .1428 CPU   2MIN 1 .2SEC MAIN 254K LCS   0K
IEF375I  JOB /PATMULTV/ START 7918 .1417
IEF376I  JOB /PATMULTV/ STOP  7918 .1428 CPU   2MIN 1 .2 SEC
```

UNIVARIATE AND MULTIVARIATE ANALYSIS OF VARIANCE, COVARIANCE, AND REGRESSION

PROGRAM VERSION 5.3 DISTRIBUTED BY

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NAFEC

ATLANTIC CITY, N.J. 08405

ON THE

IBM 36 /9[illegible]2

PROBLEM

ANALYSIS OF VRS QUESTIONNAIRE - QUESTION 6

INPUT PARAMETERS

NUMBER OF VARIABLES IN INPUT VECTORS= 10

NUMBER OF FACTORS IN DESIGN= 4

NUMBER OF LEVELS OF FACTOR 1 (L/RATING) = 2
NUMBER OF LEVELS OF FACTOR 2 (TOTFLYHR) = 2
NUMBER OF LEVELS OF FACTOR 3 (ANNFLYHR) = 2
NUMBER OF LEVELS OF FACTOR 4 (VRS USED) = 2

INPUT IS FROM CARDS, DATA OPTION ?

MINIMAL PAGE SPACING WILL BE USED

FORMAT OF DATA
(12X,10F1.0)

FIRST OBSERVATION
SUBJECT 1 , CELL 1 1 1 1
5.0000 5.0000 4.0000 4.0000 4.0000 5.0000 5.0000 5.0000
5.0000 5.0000

CELL IDENTIFICATION AND FREQUENCIES

CELL	FACTOR LEVELS				N
	L/RATING	TOTFLYHR	ANNFLYHR	VRS USED	
1	1	1	1	1	65
2	1	1	1	2	28
3	1	1	2	1	26
4	1	1	2	2	22
5	1	2	1	1	15
6	1	2	1	2	4
7	1	2	2	1	15
8	1	2	2	2	4
9	2	1	1	1	7
10	2	1	1	2	2
11	2	1	2	1	5
12	2	1	2	2	8
13	2	2	1	1	4

14	2	2	1	2	14
15	2	2	2	1	93
16	2	2	2	2	56

TOTAL N= 434.

OBSERVED CELL MEANS --- ROWS ARE CELLS-COLUMNS ARE VARIABLES

	1 INFO SAT	2 INFO SUF	3 RATEFAST	4 CLR PICT	5 LACKINFO	6 VRS DIFC	7 INTELLIG	8 UNATURAL	9 UNPLEASA	10 BKF SATF
1	4.[illegible]15385	3.953846	3.846154	3.646154	3.476923	3.846154	3.907692	3.846154	4.[illegible]23.769	3.984615
2	4.285714	4.1 7143	4.285714	3. 714286	3.500000	4.321429	3.857143	3.821429	4.285714	4.214286
3	4. 76923	3.884615	4.[illegible]	3.538462	3.461538	3.730769	3.653846	3.538462	4.269231	3.961538
4	4.627273	4.318182	4.136364	3.863636	3.5[illegible]	4.318182	4.[illegible]69455	4. 45455	4.363636	4.136364
5	3.933333	4.133333	4.000000	3.666667	3.333333	3.666667	4.000000	4.133333	4.333333	3.933333
6	4.250000	4.250000	4.[illegible]	3.000000	2.750000	4.250000	4.500000	4.250000	4.500000	4.500000
7	4.266667	4.333333	4.[illegible]	3.866667	3.333333	3.333333	4.[illegible]	3.666667	4.133333	4.133333
8	4.[illegible]000	4.750000	3.750000	3.500000	2.750000	3.750000	3.000000	4.250000	4.500000	3.750000
9	4.[illegible]	3.857143	3.142857	3.857143	3.000000	3.571429	4.000000	3.571429	4.571429	4.[illegible]
1	4.5	3.	4.5	3.5[illegible]	3.[illegible]00000	4.000000	2.500000	4.000000	4.500000	4.000000
11	4.4[illegible]	4.6[illegible]	4.6[illegible]	3.000000	3.[illegible]	4.[illegible]	4.[illegible]	4.[illegible]	4.[illegible]	3.[illegible]
12	4.625000	4.125000	4.250000	3.875000	2.75[illegible]	3.875[illegible]	3.5[illegible]	3.75[illegible]	4.375[illegible]	4.125[illegible]
13	4.2[illegible]	4.[illegible]25000	4.[illegible]00000	3.[illegible]00000	3.[illegible]75000	4.[illegible]25000	4.[illegible]50000	4.[illegible]50000	4.[illegible]75000	4.[illegible]75000
14	4.357143	4.[illegible]	3.857143	3.928571	3.571429	4.[illegible]71429	3.857143	3.857143	4.357143	4.[illegible]71429
15	4.139785	4. 1 753	4. 43 11	3.7 9677	3.387 97	3.946237	3.892473	3.989247	4.247312	3.892473
16	4.214286	4.[illegible]71429	4.428571	3. 714286	3.339286	4.267857	3.696429	4.[illegible]53571	4.446429	4.160714

OBSERVED CELL STD DEVS--ROWS ARE CELLS-COLUMNS VARIABLES

	1 INFO SAT	2 INFO SUF	3 RATEFAST	4 CLR PICT	5 LACKINFO	6 VRS DIFC	7 INTELLIG	8 UNATURAL	9 UNPLEASA	10 BKF SATF
1	.838382	.855694	1.[illegible]6739	.837234	1.091681	1.[illegible]1949	1.195344	.887954	0.701989	0.838382
2	.46 44	.875142	.712647	.9759[illegible]	.922958	.722832	1.432798	1.055973	0.460044	0.629941
3	.271746	.938334	.979796	.811456	.904689	1.[illegible]23[illegible]	1.198075	.904689	0.452344	0.726343
4	.428932	.779388	.888884	.639632	.912871	.716231	1.214395	.843873	.452366	0.639642
5	1. 32796	.516398	1.195229	1.046536	0.899735	1.290994	1.[illegible]14185	0.743223	0.487950	0.798809
6	.5[illegible]	.5[illegible]	.[illegible]	2.[illegible]	.957427	.5[illegible]	.577357	0.957427	0.577350	0.577350
7	.457733	.437957	.377964	.351865	.9759[illegible]	1.397276	1.133893	.[illegible]99735	.516398	.[illegible]
8	.[illegible]	.5[illegible]	1.892969	1.000000	1.258306	1.258306	1.325742	.957427	0.577350	1.258366
9	.[illegible]	.[illegible]99735	1.462385	.377964	1.293994	1.133893	1.414214	1.133893	0.534522	0.[illegible]
1	.7 71 7	1.414214	.7 71 7	.7 71 7	1.414214	.[illegible]	2.12132	.[illegible]	0.707107	0.0
11	.547723	.[illegible]83666	.547723	1.224745	.[illegible]83666	.7[illegible]7	1.732051	0.547723	0.547723	1.[illegible]
12	.517549	.991 31	1.[illegible]98	0.640870	1.388736	1.552648	1.[illegible]5164[illegible]	1.164965	1.[illegible]	.64[illegible]
13	.[illegible]32	1.12 611	1.1 [illegible]	.939176	0.946993	1.097491	1.131144	0.904405	0.540062	0.858965
14	.497245	1.1 94	1.511858	.828742	.937614	.7[illegible]	1.[illegible]98423	0.864438	0.497245	0.474031
15	.[illegible]43967	.[illegible]73117	.956534	.774325	1.[illegible]63549	1.[illegible]3966	1.2464 7	.[illegible]84 479	.732119	.84[illegible]
16	.[illegible]	.[illegible]	.[illegible]	1.[illegible]56827	1.213211	.[illegible]	1.[illegible]30541	0.961432	0.711425	0.[illegible]

OBSERVED COMBINED MEANS

FACTORS 1 (EL/RATING)

LEVEL 1
N = 179.

MEANS					
INFO SAT= 4.112	INFO SUF= 4.084	RATEFAST= 3.927	CLR PICT= 3.670	LACKINFO= 3.425
VRS DIFC= 3.911	INTELLIG= 3.905	UNATURAL= 3.845	UNPLEASA= 4.274	BRF SATF= 4.050

LEVEL 2
N = 225.

MEANS					
INFO SAT= 4.214	INFO SUF= 4.122	RATEFAST= 4.133	CLR PICT= 3.716	LACKINFO= 3.413
VRS DIFC= 4.036	INTELLIG= 3.818	UNATURAL= 3.996	UNPLEASA= 4.347	BRF SATF= 4.013

FACTORS 2 (TOTELYHR)

LEVEL 1
N = 163.

MEANS					
INFO SAT= 4.147	INFO SUF= 4.018	RATEFAST= 3.926	CLR PICT= 3.669	LACKINFO= 3.411
VRS DIFC= 3.969	INTELLIG= 3.847	UNATURAL= 3.822	UNPLEASA= 4.294	BRF SATF= 4.043

LEVEL 2
N = 241.

MEANS					
INFO SAT= 4.174	INFO SUF= 4.171	RATEFAST= 4.129	CLR PICT= 3.714	LACKINFO= 3.423
VRS DIFC= 3.983	INTELLIG= 3.863	UNATURAL= 4.094	UNPLEASA= 4.328	BRF SATF= 4.021

FACTORS 3 (ANNELYHR)

LEVEL 1
N = 175.

MEANS					
INFO SAT= 4.131	INFO SUF= 4.096	RATEFAST= 3.897	CLR PICT= 3.686	LACKINFO= 3.503
VRS DIFC= 3.966	INTELLIG= 3.914	UNATURAL= 3.914	UNPLEASA= 4.214	BRF SATF= 4.057

LEVEL 2
N = 229.

MEANS					
INFO SAT= 4.188	INFO SUF= 4.093	RATEFAST= 4.153	CLR PICT= 3.713	LACKINFO= 3.334
VRS DIFC= 3.931	INTELLIG= 3.812	UNATURAL= 3.943	UNPLEASA= 4.314	BRF SATF= 4.009

FACTORS 4 (VRS USED)

LEVEL 1
N = 266.

MEANS	INFO SAT= 4.1?9	INFO SUF= 4. 11	RATEFAST= 3.932	CLR PICT= 3.673	LACKINFO= 3.455
	VRS DIFC= 3.353	INTELLIG= 3.925	UNATURAL= 3.906	UNPLEASA= 4.274	BKF SATF= 3.966

LEVEL 2
N = 136.

MEANS	INFO SAT= 4.258	INFO SUF= 4.123	RATEFAST= 4.254	CLR PICT= 3.739	LACKINFO= 3.348
	VRS DIFC= 4.225	INTELLIG= 3.725	UNATURAL= 3.978	UNPLEASA= 4.391	BKF SATF= 4.152

ESTIMATION PARAMETERS

PAGE 5

RANK OF THE BASIS = RANK OF MODEL FOR SIGNIFICANCE TESTING = 5

RANK OF THE MODEL TO BE ESTIMATED IS 5

ERROR TERM TO BE USED IS (RESIDUAL)

NUMBER OF ORDERS OF THE BASIS VECTORS OTHER THAN THE FIRST IS 3

ESTIMATED CELL MEANS, RESIDUALS AND RESIDUALS IN FORM OF T-STATISTICS WILL BE PRINTED

SYMBOLIC CONTRAST VECTORS

PAGE 6

(1)
DO,DO,DO,DO,

(2) L/RATING
D1, , , ,

(3) TOTFLYHR
?,D1,?,?,

(4) ANNFLYH9
?,?,D1,?,

(5) VRS USED
?,?,?,D1,

ERROR CORRELATION MATRIX

	1 INFO SAT	2 INFO SUF	3 RATEFAST	4 CLR PICT	5 LACKINFO	6 VRS DIFC	7 INTELLIG	8 UNATURAL	9 UNPLEASA	10 BKF SATF
1 INFO SAT	1.[illegible]									
2 INFO SUF	.467540	1.								
3 RATEFAST	[illegible].266[illegible]71	0.217200	1.[illegible]							
4 CLR PICT	[illegible].3526 3	.444375	.158288	1.[illegible]						
5 LACKINFO	.211 36	.23765	.19 718	.42565	1.000001					
6 VRS DIFC	.3329 2	.1512 6	.2849 8	[illegible].167757	[illegible].188816	1.[illegible]				
7 INTELLIG	[illegible].127177	. 37748	.1253 3	0. 25028	[illegible]. 42541	. 5 97	1.[illegible]			
8 UNATURAL	.156243	[illegible].135444	.212733	[illegible].131637	[illegible].133463	0.159677	0.014532	1.000000		

B-8

9 UNPLEASA	[illegible]	0.113462	[illegible]	0.196971	[illegible]	[illegible]	[illegible]	0.555881	1.000000	
1 BRF SATF	[illegible]	.472125	.213718	.462414	[illegible]	0.236148	0.029814	0.144108	0.222723	1.000000

VARIABLE	VARIANCE (ERROR MEAN SQUARES)	STANDARD DEVIATION
1 INFO SAT	[illegible]	[illegible]
2 INFO SUF	[illegible]	0.8479
3 RATEFAST	[illegible]	[illegible]
4 CLR PICT	[illegible]	[illegible]
5 LACKINFO	1.075379	1.0370
6 VRS DIFC	[illegible]	[illegible]
7 INTELLIG	1.689554	1.2998
8 UNATURAL	0.811972	0.9011
9 UNPLEASA	[illegible]	[illegible]
1 BRF SATF	[illegible]	[illegible]

D.F.= 399.

ERROR TERM FOR ANALYSIS OF VARIANCE (RESIDUAL)

LEAST SQUAPE ESTIMATES OF EFFECTS -- EFFECTS X VARIABLES

	1 INFO SAT	2 INFO SUF	3 RATEFAST	4 CLR PICT	5 LACKINFO	6 VRS DIFC	7 INTELLIG	8 UNATURAL	9 UNPLEASA	10 BRF SATF
1	4.184811	[illegible]	[illegible]	[illegible]	3.409953	[illegible]	[illegible]	3.928574	4.331946	[illegible]
2	[illegible]	.112178	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.024958
3	[illegible]	[illegible]	[illegible]	-0.017925	-0.026376	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	.151571	[illegible]	[illegible]	-0.184246	[illegible]	-0.042753	[illegible]	[illegible]

ESTIMATES OF EFFECTS IN STANDARD DEVIATION UNITS-EFF X VARS

	1 INFO SAT	2 INFO SUF	3 RATEFAST	4 CLR PICT	5 LACKINFO	6 VRS DIFC	7 INTELLIG	8 UNATURAL	9 UNPLEASA	10 BRF SATF
1	[illegible]	[illegible]	[illegible]	[illegible]	3.283271	[illegible]	2.945381	[illegible]	[illegible]	5.177597
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-0.095557	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STANDARD ERRORS OF LEAST-SQUARES ESTIMATES--EFFECTS BY VARS

1	2	3	4	5	6	7

	INFO SAT	INFO SUF	RATEFAST	CLR PICT	LACKINFO	VRS DIFC	INTELLIG
1	3.698721D-02	4.544857D-02	5.175118D-02	4.685717D-02	5.558562D-02	5.308577D-02	6.967351D-02
2	4.922721D-02	6.048135D-02	6.886716D-02	6.235453D-02	7.396973D-02	7.064314D-02	9.271714D-02
3	4.954093D-02	6.087411D-02	6.931597D-02	6.276089D-02	7.445173D-02	7.110342D-02	9.332114D-02
4	3.751113D-02	4.609223D-02	5.248410D-02	4.752978D-02	5.637284D-02	5.383759D-02	7.066024D-02
5	3.67[illegible]994D-02	4.51[illegible]787D-02	5.136324D-02	4.65[illegible]591D-02	5.516892D-02	5.268782D-02	6.915121D-02

	8 UNATURAL	9 UNPLEASA	1 BRF SATF
1	4.83[illegible]55D-02	3.416934D-02	4.207703D-02
2	6.427529D-02	4.533690D-02	5.599342D-02
3	6.4694[illegible]7D-02	4.563229D-02	5.635824D-02
4	4.89846[illegible]D-02	3.455154D-02	4.267294D-02
5	4.793847D-02	3.381365D-02	4.176160D-02

LEAST-SQUARES ESTIMATES AS T-STATISTICS - EFFECTS X VARS

	1 INFO SAT	2 INFO SUF	3 RATEFAST	4 CLR PICT	5 LACKINFO	6 VRS DIFC	7 INTELLIG	8 UNATURAL	9 UNPLEASA	10 BRF SATF
1	113.1421	89.2713	76.5492	79.0132	61.3463	76.0931	54.9434	81.3360	127.1520	96.5932
2	-1.2497	1.8548	[illegible].4722	-[illegible].1732	-[illegible].[illegible]683	-1.3359	0.8283	-0.3291	-1.0281	0.4457
3	[illegible].5939	-1.5599	-0.7856	-0.2856	-0.3543	[illegible].5628	-[illegible].7519	-1.3310	0.1513	-1.3912
4	-[illegible].1875	-0.8794	-1.5494	0.1013	1.4133	0.5428	0.5[illegible]86	[illegible].5145	[illegible].6[illegible]71	[illegible].8.4[illegible]
5	-2.[illegible]466	1.31[illegible]2	2.9513	-0.7354	0.7635	-3.4969	1.2933	-0.8918	-1.7511	-2.3793

DEGREES OF FREEDOM = 399.

ESTIMATED CELL MEANS, ALL GROUPS - CELLS X VARIABLES

	1 INFO SAT	2 INFO SUF	3 RATEFAST	4 CLR PICT	5 LACKINFO	6 VRS DIFC	7 INTELLIG	8 UNATURAL	9 UNPLEASA	10 BRF SATF
1	4.[illegible]7[illegible]58	3.974841	3.745131	3.644223	3.533324	3.83[illegible]8[illegible]	3.96[illegible]96	3.803765	4.254005	4.002210
2	4.223319	4.[illegible]93[illegible]39	4.048293	3.712625	3.416377	4.198573	3.781227	3.889271	4.372429	4.2[illegible]937
3	4.[illegible]9413	4.[illegible]55[illegible]4	3.9[illegible]7793	3.634590	3.340977	3.771638	3.888219	3.753358	4.212053	3.933592
4	4.234391	4.1741[illegible]3	4.21[illegible]934	3.702995	3.256733	4.14[illegible]13[illegible]	3.709350	3.838864	4.330477	4.132319
5	4.[illegible]122[illegible]7	4.104755	3.859[illegible]65	3.68[illegible]71	3.553[illegible]76	3.75[illegible]46	4.1[illegible]439	3.975976	4.24[illegible]197	4.[illegible]463[illegible]6
6	4.162469	4.232753	4.1572[illegible]7	3.748475	3.468329	4.118539	3.921570	4.[illegible]61482	4.358021	4.245033
7	4.[illegible]26270	4.245819	4.[illegible]167[illegible]6	3.670441	3.393729	3.691604	4.028561	3.925569	4.198245	3.977089
8	4.17654	4.304[illegible]17	4.319348	3.738845	3.2[illegible]9482	4.[illegible]6[illegible]96	3.849693	4.[illegible]11975	4.316069	4.176416
9	4.193[illegible]81	3.75[illegible]85	3.810133	3.665823	3.51[illegible]423	4.[illegible]18823	3.830537	3.846[illegible]74	4.347224	3.952295
10	4.343342	3.803784	4.115325	3.734227	3.426176	4.287216	3.627638	3.931580	4.465648	4.151022
11	4.2[illegible]7153	3.321549	3.972825	3.656193	3.351[illegible]77	3.960381	3.734529	3.795666	4.305272	3.883077
12	4.357414	3.943747	4.275907	3.724597	3.266829	4.328873	3.555761	3.881173	4.423096	4.082404
13	4.13523[illegible]	3.94[illegible]	3.919[illegible]97	3.7[illegible]1673	3.563176	3.[illegible]28739	3.94685	4.[illegible]18285	4.333415	3.996391
14	4.285[illegible]91	4.[illegible]93398	4.222239	3.77[illegible]177	3.478928	4.307282	3.767981	4.103791	4.451643	4.195118

15	4.149312	4.321463	4.081739	3.692043	3.403829	3.880347	3.874972	3.967878	4.251464	3.927774
16	4.299563	4.133062	4.384880	3.760447	3.319582	4.248839	3.696104	4.053384	4.409888	4.126501

MEANS ESTIMATED BY FITTING MODEL OF RANK 5

RAW RESIDUALS - ROWS ARE FULL CELLS - COLUMNS ARE VARIABLES

	1 INFO SAT	2 INFO SUF	3 RATEFAST	4 CLR PICT	5 LACKINFO	6 VRS DIFC	7 INTELLIG	8 UNATURAL	9 UNPLEASA	1. BRF SATF
1	-0. 54673	-0.020995	-0. 98997	0. 11933	-0. 234 1	. 16 74	- .0524 3	. 42389	-0. 23236	- . 17594
2	0. 65395	0.014104	0.237421	0.001661	0.083923	0.122856	0.075916	-0.067843	-0.086715	0.013349
3	-0. 07237	-0.171289	.092207	-0.096120	0.120561	-0.040865	-0.234372	-0.214896	0.057178	0.027946
4	- . 7118	.144 79	- . 74571	0.16 642	.24327	.178 51	.336105	0.206590	0.033159	0.004045
5	-0.078874	0.031422	0.145935	-0.013404	-0.219743	-0.083375	0.099561	0.157358	0.093137	-0.112973
6	0. 87531	-0.032953	-0.157207	-0.748475	-0.719829	0.131461	0.57843	.188518	.141375	.254967
7	.24 388	0. 37515	-0. 167 6	0.196226	-0.060396	-0.358270	-0.028561	-0.258902	-0.064912	0.155645
8	-0.17654	0.385983	-0.569848	-0.238845	-0.559482	-0.310096	-0.849693	0.238925	0.182331	-0.426416
9	-0.193081	0.106657	-0.667326	0.19132	-0.51 423	- .447395	.193493	-0.274645	0.2242.5	. 47735
10	0.150653	0.303084	0.386675	-0.234227	-0.426176	-0.387316	-1.127638	0.068420	0.034352	-0.151022
11	0.192847	0.368451	0.627175	-0.656193	-0.151077	0.039615	0.265371	0.604334	0.094728	-0.083677
12	.267586	.175253	- . 25967	0.150403	-0.516829	- .453873	- . 55761	-0.131173	-0.048696	0.042596
13	0.064770	0.084600	0.180913	-0.001673	0.211824	0.086211	0.103150	0.031715	0.041585	0.078609
14	0. 71631	-0.053598	-0.365095	0.158494	0.092500	-0.235853	-0.410838	-0.246649	-0. 94697	- .12369.
15	-0. 9517	-0. 1 711	. 38728	0. 17634	-0.016732	0.065890	0.017501	0.021370	-0.044152	-0.035300
16	-0. 85278	-0.068233	0.043691	-0.046161	0.019704	0.019018	0.002325	0.000187	0. 36541	0.034214

RESIDUALS IN STD. DEV. UNITS - FULL CELLS X VARIABLES

	1 INFO SAT	2 INFO SUF	3 RATEFAST	4 CLR PICT	5 LACKINFO	6 VRS DIFC	7 INTELLIG	8 UNATURAL	9 UNPLEASA	1. BRF SATF
1	-0. 79233	-0.024761	-0.102538	0.002212	-0. 22566	0. 1623	- .04 316	0. 47 42	- . 36558	-0.022414
2	.094771	0.016634	0.245913	0.001900	0.080929	0.124051	0.058404	-0.075239	-0.136431	0.017005
3	- . 1 444	-0.212 18	0.095515	-0.109966	0.116259	-0.041266	-0.183317	-0.238483	0.089960	0.035601
4	-0. 10316	.169927	- . 77238	0.183756	0.234589	.179783	.258576	0.229266	. 52171	0.005152
5	-0.114334	-0.037059	0.151154	-0.015334	-0.211902	-0.084190	0.076596	0.174629	0.146535	-0.143917
6	0.126851	-0. 38865	-0.162829	-0.856215	-0.693178	0.132740	0.445005	0.209209	0.222437	0.324803
7	.348371	.1 3215	. 172 4	0.224472	- . 58241	- .361755	-0.021973	-0.297319	0.102128	0.198276
8	-0.255843	0.455229	-0.590229	-0.273226	-0.539517	-0.313112	-0.653696	0.265149	0.288441	-0.543212
9	-0.275814	0.125792	-0.691193	0.218860	-0.492259	-0.451746	.148861	-0.3 479	.35275.	. 6.772
1	.227 29	1. 24526	0.400504	-0.267943	-0.410968	-0.391083	-0.867528	0.075929	0.054048	-0.192387
11	0.275476	0.434551	0.649616	-0.750649	-0.145685	0.040005	0.204158	0.670666	0.149039	-0.106596
12	0.387787	0.2 0693	- . 26895	.172 53	-0.498387	- .458288	- . 42898	-0.145571	-0. 76615	0. 54263
13	0.093865	0.099773	0.187373	-0.001914	0.204266	0.087050	0.079357	0.035196	0.005426	0.100140
14	0.1 3838	-0. 6911	-0.378154	0.181309	0.089199	-0.228147	-0.316071	-0.273721	-0.148990	-0.157569
15	- . 13792	-0. 12602	. 4 113	. 2 173	-0. 16135	. 06531	. 13464	0.023715	-0.069466	-0.044969
16	-0.123535	0.082474	0.045254	-0.052806	0.019001	. 15203	0.002250	0.000208	0.057491	0.043585

RESIDUALS AS T-STATISTICS - FULL CELLS X VARIABLES

	1	2	3	4	5	6	7	8	9	1.

	INFO SAT	INFO SUF	RATEFAST	CLR PICT	LACKINFO	VRS DIFC	INTELLIG	UNATURAL	UNPLEASA	BRF SATF
1	-0.984235	-0.237583	-1.273737	0.27474	-0.28 314	.2 16 9	- .5 8 4	.584359	-0.454121	-0.278423
2	0.033130	0.111136	1.642987	0.012696	0.540698	0.828804	0.399210	-0.503 21	-0.911523	0.113616
3	-0. 664 2	-1.284436	0.617222	-0.699167	0.739177	-0.262371	-1.146413	-1.516280	0.571965	0.226351
4	-0. 59172	.974685	.443 29	1. 54 61	1.34558	1. 31218	1.483169	1.315046	0.299245	0.029554
5	-0.535845	0.173727	0.708595	-0.371882	-0.593370	-0.394675	0.359071	0.818643	0.086940	-0.674665
6	0.269831	-0.062672	-0.346261	-1.821293	-1.474490	0.282357	0.946589	0.445 19	0.473156	.69699 3
7	1.047717	.488182	-0. 81844	1.061701	-0.275466	-1.711017	-0.103729	-1.358954	-0.483042	0.937801
8	-0.541443	0.95349 3	-1.249135	-0.578229	-1.1417[illegible]	-0.662641	-1.383421	0.561137	0.610430	-1.149604
9	-0.82 258	0.368752	-2.026194	0.641575	-1.442883	-1.324268	.436376	-0.893476	1. 34 66	.17815
1	0.330764	1.492652	0.583503	-0.390371	-0.598748	-0.569776	-1.263919	0.110623	0.078743	-0.280292
11	0.670000	1.141769	1.557330	-1.799565	-0.349258	0.095995	0.489438	1.607817	0.357299	-0.255548
12	1.2283 1	.654693	- . 8519	0.544972	-1.57862	-1.4516 9	- .135879	-0.461 91	- .242075	0.171877
13	0.810293	0.861241	1.617329	-0.016520	1.763140	0.751377	0.684976	0.303802	0.564735	0.804369
14	0.446707	-0.297311	-1.626007	0.779986	0.383734	-1.024502	-1.359730	-1.177541	-0.640950	-0.677856
15	- .227464	0.2 8341	.661573	.3327 5	-0.26611	1.097277	0.222058	0.391131	-1.145682	-0.741609
16	-1.378640	0.897724	0.504826	-0.589076	0.211965	0.214218	0.002789	0.002315	0.641337	1.486210

D.F.= 399.

RESIDUALS ESTIMATED AFTER FITTING MODEL OF RANK 5

ANALYSIS OF VARIANCE

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10 DEPENDENT VARIABLE(S)

1 INFO SAT
2 INFO SUF
3 RATEFAST
4 CLR PICT
5 LACKINFO
6 VRS DIFC
7 INTELLIG
8 UNATURAL
9 UNPLEASA
1 BRF SATF

NUMBER OF ALTERNATE BASIS ORDERS= 3

PRINCIPAL COMPONENTS OF CORRELATION MATRIX WILL BE PRINTED

DISCRIMINANT ANALYSIS WILL BE PERFORMED FOR EACH BETWEEN CELL HYPOTHESIS

PRINCIPAL COMPONENTS -- VARIABLES X COMPONENTS (ROWS X COLS)

	1	2	3	4	5	6	7	8	9	10
1 INFO SAT	-0.779243	0.090435	0.301264	0.124175	0.439428	0.227513	0.055886	0. 45898	0.346578	0.235910
2 INFO SUF	.676364	.33345	. 62961	-0.158934	0.1 7725	.736 8	0.162550	-0.416824	-0.156993	-0.275695
3 RATEFAST	- .457277	- .313 1	.298637	.256837	.52 7	.456573	- .122101	0.062937	-0.042029	-0.003126

4 CLR PICT	-0.665593	0.325167	-0.177832	-0.186236	0.005829	-0.110018	-0.017182	0.049682	0.037166	-0.046343
5 LACKINFO	-0.639481	0.287699	-0.300358	0.202476	-0.466134	-0.279997	.231681	-0.139379	0.23660.	.183261
6 VRS DIFC	-0.487788	0.253799	0.221139	0.619785	0.126887	-0.437947	-0.063167	-0.168449	-0.151881	-0.036135
7 INTELLIG	-0.126134	-0.111.69	0.773750	-0.520653	-0.124048	-0.289297	0.022792	0.001062	-0.026424	0.042477
8 UNATURAL	-.44 59	-.53617	-.3328 5	-0.294516	0.121919	.738 2	-.1 521	-0.178364	-0.241487	0.305151
9 UNPLEASA	-0.529831	-0.642517	-0.204712	-0.156005	0.050578	-0.496013	0.108629	0.157780	0.255354	-0.356018
10 BRF SATF	-0.713872	0.293.89	-0.062133	-0.033409	0.056071	-0.540228	0.218899	0.485145	-.318786	.. 12762

VECTOR	EIGENVALUE	PER CENT OF VARIATION
1	3.225410	32.2541
2	1.412788	14.1279
3	1.1 8896	11. 9
4	0.906628	9.0663
5	0.744611	7.4461
6	0.698194	6.9819
7	0.543294	5.4329
8	0.521923	5.2192
9	.448179	4.4818
10	0.389998	3.900

COMPUTED FROM CORRELATION MATRIX

HYPOTHESIS 1 1 DEGREE(S) OF FREEDOM

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F-RATIO FOR MULTIVARIATE TEST OF EQUALITY OF MEAN VECTORS= 3135. 942

D.F.= 10. AND 39 .0000 P LESS THAN 0.0001

VARIABLE	HYPOTHESIS MEAN SQ	UNIVARIATE F	P LESS THAN	STEP DOWN F	P LESS THAN
1 INFO SAT	72 .7822	14707.2266	0.0001	14707.2266	0.0001
2 INFO SUF	6624. 7731	9215.2695	0.0001	52. 638	0.0001
3 RATEFAST	6630.7153	7331.3096	0.0001	53.4121	0.0001
4 CLR PICT	5517.4481	7220.1992	0.0001	18.6492	0.0001
5 LACKINFO	472 .6955	4389.7969	0.0001	3.853	0.0504
6 VRS DIFC	6490.1934	6525.2578	0.0001	18.1974	0.0001
7 INTELLIG	3578.3767	3536.1616	0.0001	31.6477	0.0001
8 UNATURAL	6241.9486	7647.3828	0.0001	50.6852	0.0001
9 UNPLEASA	7519.9233	18614.7344	0.0001	86.4634	0.0001
10 BRF SATF	3507.3964	11646.3437	0.0001	6.4785	0.013

DEGREES OF FREEDOM FOR HYPOTHESIS= 1
DEGREES OF FREEDOM FOR ERROR= 359.

DISCRIMINANT ANALYSIS FOR HYPOTHESIS 1

VARIANCE OF CANONICAL VARIATE 1 = B .3894 PER CENT OF CANONICAL VARIATION= 100.00 ROY'S CRITERION= 0.9877
M= 4.0 N= 194.0

--DISCRIMINANT FUNCTION COEFFICIENTS--

VARIABLE	RAW COEFFICIENT	STANDARDIZED
1 INFO SAT	-[illegible]637	-0.2765
2 INFO SUF	-0.203591	-0.1726
3 RATEFAST	-0.096697	-[illegible]934
4 CLR PICT	-0.083983	-0.0734
5 LACKINFO	-0.009869	-0.0089
6 VRS DIFC	-[illegible]93873	-[illegible]93
7 INTELLIG	-0.173898	-0.2260
8 UNATURAL	-0.063736	-0.0574
9 UNPLEASA	-[illegible]828269	-[illegible].5264
10 BRF SATF	-0.209845	-0.1647

HOTELLING'S TRACE CRITERION= B .3894

BARTLETT'S CHI SQUARE TEST FOR SIGNIFICANCE OF SUCCESSIVE CANONICAL VARIATES

FOR ROOTS 1 THROUGH 1 CHI SQUARE= 1733.322 WITH 1. DEGREES OF FREEDOM P LESS THAN 1

CANONICAL FORM OF LEAST SQUARE ESTIMATES-VARIATES & EFFECTS

1

1 -0.945651

HYPOTHESIS 2 1 DEGREE(S) OF FREEDOM

DI[illegible] L/RATING

F-RATIO FOR MULTIVARIATE TEST OF EQUALITY OF MEAN VECTORS= 1.175

D.F.= 10. AND 390.0000 P LESS THAN 0.3090

	VARIABLE	HYPOTHESIS MEAN SQ	UNIVARIATE F	P LESS THAN	STEP DOWN F	P LESS THAN
1	INFO SAT	.8569	1.7997	0.1805	1.7997	0.1805
2	INFO SUF	.278	.5258	.4685	2.3241	0.1282
3	RATEFAST	4.2288	4.5367	0.0338	3.7923	0.0522
4	CLR PICT	0.2534	0.2661	0.6063	0.2687	.6046
5	LACKINFO	.126	.117	0.9139	0.0668	0.7963
6	VRS DIFC	1.5562	1.5866	.2085	0.1971	0.6574
7	INTELLIG	.7589	.4492	.5023	.951	.33.2
8	UNATURAL	2.1365	2.6312	0.1056	1.2055	0.2729
9	UNPLEASA	.5311	1.3123	.2526	0.0616	0.8042
10	BRF SATF	0.1361	.2278	.6388	1.[illegible]83	.2992

DEGREES OF FREEDOM FOR HYPOTHESIS= 1
DEGREES OF FREEDOM FOR ERROR= 399.

DISCRIMINANT ANALYSIS FOR HYPOTHESIS 2

VARIANCE OF CANONICAL VARIATE 1 = .3 PER CENT OF CANONICAL VARIATION= 100.00 ROY'S CRITERION= 0.0292
M= 4.0 N= 194.0

--DISCRIMINANT FUNCTION COEFFICIENTS--

	VARIABLE	RAW COEFFICIENT	STANDARDIZED
1	INFO SAT	.734357	0.5367
2	INFO SUF	-0.592237	-0.5322
3	RATEFAST	.584588	.5694
4	CLR PICT	0.268998	0.2351
5	LACKINFO	-0.046328	-[illegible]480
6	VRS DIFC	.147122	.1457
7	INTELLIG	-0.220121	-0.2361
8	UNATURAL	0.413533	0.3726
9	UNPLEASA	-.144418	-[illegible].064
10	BRF SATF	-0.502183	-0.3942

HOTELLING'S TRACE CRITERION= .3

BARTLETT'S CHI SQUARE TEST FOR SIGNIFICANCE OF SUCCESSIVE CANONICAL VARIATES

FOR POINTS 1 THROUGH 1 CHI SQUARE= 11.6578 WITH 1*. DEGREES OF FREEDOM P LESS THAN 0.3)o7

CANONICAL FORM OF LEAST SQUARE ESTIMATES-VARIATES X EFFECTS

	1
	L/RATING
1	-1.13(47)

HYPOTHESIS 3 1 DEGREE(S) OF FREEDOM

.01. . .

TOTFLYHR

F-RATIO FOR MULTIVARIATE TEST OF EQUALITY OF MEAN VECTORS= 0.9694

D.F.= 1*. AND 39*.**** P LESS THAN 0.4698

	VARIABLE	HYPOTHESIS MEAN SQ	UNIVARIATE F	P LESS THAN	STEP DOWN F	P LESS THAN
1	INFO SAT	.2822	0.5926	0.4420	0.5926	0.4420
2	INFO SUF	1.7341	2.419*	0.1207	4.6757	0.0312
3	RATERASI	0.4424	0.4746	0.4914	0.5729	0.4497
4	CLR PICT	.323	0.0422	0.8374	0.0086	0.7936
5	LACKINFO	0.771	0.0717	0.7891	0.1257	0.7233
6	VRS DIEC	0.0346	.9329	.3298	.7667	0.3818
7	INTELLIG	1.1603	0.6867	0.4079	0.5563	0.4555
8	UNATURAL	1.17.7	1.4418	0.2305	1.4127	0.2353
9	UNPLEASA	.633	.1568	.6925	0.9727	0.3247
10	BRF SATF	0.0329	0.0048	0.945*	0.1058	0.9394

DEGREES OF FREEDOM FOR HYPOTHESIS= 1
DEGREES OF FREEDOM FOR ERROR= 39*.

DISCRIMINANT ANALYSIS FOR HYPOTHESIS 3

VARIANCE OF CANONICAL VARIATE 1 = 0.0249 PER CENT OF CANONICAL VARIATION= 100.00 ROY'S CRITERION= 0.0243
M= 4.0 N= 194.0

--DISCRIMINANT FUNCTION COEFFICIENTS--

VARIABLE	RAW COEFFICIENT	STANDARDIZED
1 INFO SAT	-0.815241	-0.5624
2 INFO SUF	.878 41	.7445
3 RATEFAST	0.294176	0.2849
4 CLR PICT	-0.081198	-0.0739
5 LACKINFO	-0.032231	-0.0334
6 VRS DIFC	-0.284398	-0.2916
7 INTELLIG	0.209427	0.2722
8 UNATURAL	0.666695	0.5389
9 UNPLEASA	-0.633572	-0.4027
1 DIFF SATF	-0.4391	-0.317

HOTELLING'S TRACE CRITERION= 0.0249

BARTLETT'S CHI SQUARE TEST FOR SIGNIFICANCE OF SUCCESSIVE CANONICAL VARIATES

FOR ROOTS 1 THROUGH 1 CHI SQUARE= 9.6756 WITH 10. DEGREES OF FREEDOM P LESS THAN 0.4694

CANONICAL FORM OF LEAST SQUARE ESTIMATES-VARIATES X EFFECTS

	1 TOTELYHR
1	-1.257854

HYPOTHESIS 4 1 DEGREE(S) OF FREEDOM

0.0001 ANNELYH9

F-RATIO FOR MULTIVARIATE TEST OF EQUALITY OF MEAN VECTORS= 1.2312

D.F.= 10. AND 390. P LESS THAN 0.2689

VARIABLE	HYPOTHESIS MEAN SQ	UNIVARIATE F	P LESS THAN	STEP DOWN F	P LESS THAN

1	INFO SAT	0.1323	0.2147	0.6434	0.2147	0.6434
2	INFO SUF	.8119	1.1294	1.2885	0.9133	0.3397
3	RATEFAST	3.5757	3.8361	0.0969	3.3211	0.0692
4	CLR PICT	0.4203	0.0930	0.9971	0.3552	0.9517
5	LACKINFO	2.5116	2.3355	0.1272	5.0863	0.0247
6	VRS DIFC	0.0061	0.0063	0.9379	0.1325	0.7161
7	INTELLIG	0.7963	.4712	0.493	1.3717	0.2422
8	UNATURAL	0.1297	0.1597	0.6897	0.5417	0.4623
9	UNPLEASA	.0577	0.1428	0.7058	0.0345	0.8528
10	BRF SATF	.1494	.2425	0.6228	0.3782	0.5391

DEGREES OF FREEDOM FOR HYPOTHESIS= 1
DEGREES OF FREEDOM FOR ERROR= 399.

DISCRIMINANT ANALYSIS FOR HYPOTHESIS 4

VARIANCE OF CANONICAL VARIATE 1 = .316 PER CENT OF CANONICAL VARIATION= 100.00 ROY'S CRITERION= 0.0306
M= 4.0 N= 199.0

--DISCRIMINANT FUNCTION COEFFICIENTS--

VARIABLE	RAW COEFFICIENT	STANDARDIZED
1 INFO SAT	-0.031718	-0.0219
2 INFO SUF	0.674927	0.5723
3 RATEFAST	0.752772	0.7268
4 CLR PICT	0.125059	0.1393
5 LACKINFO	-0.677717	-0.7228
6 VRS DIFC	-0.078682	-0.079
7 INTELLIG	-0.269255	-0.3500
8 UNATURAL	-0.214566	-0.1933
9 UNPLEASA	-0.082724	-0.526
10 BRF SATF	-0.290143	-0.2278

HOTELLING'S TRACE CRITERION= .316

BARTLETT'S CHI SQUARE TEST FOR SIGNIFICANCE OF SUCCESSIVE CANONICAL VARIATES

FOR ROOTS 1 THROUGH 1 CHI SQUARE= 12.2576 WITH 10. DEGREES OF FREEDOM P LESS THAN .2682

CANONICAL FORM OF LEAST SQUARE ESTIMATES-VARIATES X EFFECTS

1

ANALYSIS

1 -.17 816

HYPOTHESIS 5 1 DEGREE(S) OF FREEDOM

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VRS USED

F-RATIO FOR MULTIVARIATE TEST OF EQUALITY OF MEAN VECTORS= 2.8134

D.F.= 10. AND 390.0000 P LESS THAN .0023

VARIABLE	HYPOTHESIS MEAN SQ	UNIVARIATE F	P LESS THAN	STEP DOWN F	P LESS THAN
1 INFO SAT	1.9944	4.1886	.0414	4.1886	.0414
2 INFO SUF	1.2341	1.7166	.1908	3.1577	.0915
3 RATEFAST	8.1172	8.7082	.0034	5.8752	.0158
4 CLF PICT	.4133	.5499	.4626	0.0462	0.8301
5 LACKINFO	.6269	.5830	.4457	3.7029	.0839
6 VRS DIFC	11.9942	12.2286	.0016	7.2134	.0076
7 INTELIG	2.8261	1.6727	.1966	3.7288	.0594
8 UNATURAL	.6458	.7954	.3732	0.1022	.9024
9 UNPLEASA	1.2388	3.664	.0187	.5638	.4533
10 BFF SATF	5.4384	5.6611	.0179	2.9103	.0888

DEGREES OF FREEDOM FOR HYPOTHESIS= 1
DEGREES OF FREEDOM FOR ERROR= 399.

DISCRIMINANT ANALYSIS FOR HYPOTHESIS 5

VARIANCE OF CANONICAL VARIATE 1 = 1.0722 PER CENT OF CANONICAL VARIATION= 100.00 ROY'S CRITERION= 0.0673

M= 4. N= 194.

--DISCRIMINANT FUNCTION COEFFICIENTS--

VARIABLE	RAW COEFFICIENT	STANDARDIZED
1 INFO SAT	.217945	.124
2 INFO SUF	-.188368	-.1247

3 RATEFAST	-0.437541	-0.4224
4 CLR PICT	0.038538	0.0337
5 LACKINFO	.568775	.5498
6 VRS DIFC	-0.524394	-0.5143
7 INTELLIG	0.291523	0.3769
8 UNATURAL	.99166	.894
9 UNPLEASA	-0.245188	-0.1558
10 BRF SATF	-0.541196	-0.4248

HOTELLING'S TRACE CRITERION= 0.7722

BARTLETT'S CHI SQUARE TEST FOR SIGNIFICANCE OF SUCCESSIVE CANONICAL VARIATES

FOR ROOTS 1 THROUGH 1 CHI SQUARE= 27.4566 WITH 10. DEGREES OF FREEDOM P LESS THAN 0.0023

CANONICAL FORM OF LEAST SQUARE ESTIMATES-VARIATES X EFFECTS

	1 VRS USED
1	.285487

ORDER OF EFFECTS (CONTRASTS)

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1 2 4 3

HYPOTHESIS 1 1 DEGREE(S) OF FREEDOM

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[illegible]

F-RATIO FOR MULTIVARIATE TEST OF EQUALITY OF MEAN VECTORS= 3135.942

D.F.= 10. AND 39.0000 P LESS THAN 0.0001

VARIABLE	HYPOTHESIS MEAN SQ	UNIVARIATE F	P LESS THAN	STEP DOWN F	P LESS THAN
1 INFO SAT	7[illegible]2.7322	147[illegible]7.2266	[illegible]	147[illegible]7.2266	0.0001
2 INFO SUF	[illegible]	9215.2693	[illegible]	52. 638	[illegible]
3 RATEFAST	[illegible].7153	7[illegible]1.[illegible]	[illegible]	53.4121	0.0001